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ABSTRACT

Proceedings of the Sixth Colloquium on Intra-Regional Technical Training sponsored jointly by the Colombo Plan and the Government of Malaysia are presented in this report. Four working papers are presented centered around three main areas of concern: influence of technical education on economic development; how the status of technicians could be improved; and identification of areas of research and innovation. Discussions by the thirty-nine delegates which followed each paper are included. Answers to questionnaires previously submitted to each delegation relative to technical educational development in their respective countries are also provided. (The individual countries are Bangladesh, Fiji, India, Indonesia, Iran, Republic of Korea, Laos, Malaysia, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand.) Speeches and addresses delivered during the inaugural session, statements by organizational and educational representatives and observers, and closing speeches are included. (BL)

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PLANNING PROSPERITY TOGETHER

COLOMBO PLAN

INTRA-REGIONAL TECHNICIAN TRAINING

BEST COPY AVAILABLE

6TH COLLOQUIUM—1975

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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KUALA LUMPUR - MALAYSIA

THE COLOMBO PLAN

The Colombo Plan was conceived at a meeting of the Commonwealth Foreign Ministers in Colombo in January, 1950. Its aim has been the economic and social development of South and South-East Asia through the co-operative efforts of the countries in the region assisted by other member countries.

All Colombo Plan aid is negotiated bilaterally. The receiving country determines its needs and begins negotiations with a donor country on the best way to fulfil them. From the beginning, the concept of co-operation and equality among members was emphasised.

The 27 member countries of the Colombo Plan are:

Within the Region: Afghanistan, Bangladesh, Bhutan, Burma, Cambodia, Fiji, India, Indonesia, Iran, Republic of Korea, Laos, Malaysia, Republic of Maldives, Nepal, Pakistan, Papua New Guinea, the Philippines, Singapore, Sri Lanka, Thailand and Republic of Vietnam.

Outside the Region: Australia, Britain, Canada, Japan, New Zealand and the United States of America.

There are four focal points around which the Colombo Plan revolves:

(1) The Consultative Committee is the top policy-making body consisting of ministers of member governments. This Committee meets each year in one of the member countries. Its task is to survey the development of the region, assess the needs, and to examine how international co-operation—in the twin forms of capital aid and technical assistance—can help to fill the gaps in national resources and accelerate the pace of development.

(2) The Colombo Plan Council consists of the representatives of all the Colombo Plan countries most of which have diplomatic missions in Colombo. The Council, which meets regularly in Colombo, does not deal with questions of capital aid. Its task is limited to promoting and co-ordinating technical assistance in the region.

(3) The Colombo Plan Bureau is located in Colombo and has four main functions:
  (i) serving as a participating body at Consultative Committee Meetings and acting in an advisory capacity for the Meetings,
  (ii) recording all the technical assistance given to the countries of the region under the Plan,
  (iii) promoting intra-regional technician training,
  (iv) disseminating information on the Plan as a whole.

(4) The Colombo Plan Staff College for Technician Education which is located in Singapore, was established in 1974 as the first 'multilateral' Colombo Plan Project. All 27 member governments are contributing in one form or another towards its operational costs. The College's main functions are to:
  (i) undertake programmes in staff development and training for technician education staff;
  (ii) conduct study conferences and courses for senior administrators in technician education;
  (iii) promote and undertake research in the special problems of technician education and training within the region; and
  (iv) provide advisory and resource services in technician education and training to countries both within and outside the region.

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INTRODUCTION

The main aim of the Colombo Plan has been the economic and social development of the countries of South and South-East Asia by transfer of capital, technology and skill from member countries outside the region to those within the region. While initially the greater portion of aid was provided by the member countries outside the region, it was recognised that the co-operative concept and the ideals and objectives of the Colombo Plan in which the countries own efforts were assisted by other member countries, should be promoted by encouraging mutual aid within the region.

Largely as a result of a Colombo Plan Bureau Survey carried out in 1961, a Programme on Intra-Regional Technician Training was launched in 1964. The twin aims of this programme are: first, to consolidate sound country programmes of technical education and training particularly at the technician or middle level; and second, to ensure the optimum utilisation of the training facilities on a regional basis.

Major features of the Bureau's Intra-Regional Training Programme have been the national seminars and regional colloquia held in the region in recent years. The national seminars are intended to assist in building effective country programmes of human resources development while regional colloquia provide a forum for periodic and systematic exchange of ideas and comparison of country experiences. At these colloquia, which are generally held every two years and to which representatives are invited from all member countries, the Bureau has attempted to focus attention on a few important aspects of technician education and training and explore ways in which the shortage at this level could be met by regional co-operation.

The Sixth Colloquium on Intra-Regional Technician Training sponsored by the Colombo Plan through the courtesy and assistance of the Government of Malaysia was held from 21 to 25 April 1975 at the Merlin Hotel, Kuala Lumpur. It was inaugurated by the Honourable Dr. Mahathir bin Mohamad, Minister of Education, Malaysia.

The objectives of the Colloquium were:

(1) to provide a forum for a frank exchange of views on the problems relating to the training of technicians against the background of the development of skilled manpower resources in general;

(2) to highlight the problems that arise in intra-regional training vis-a-vis training outside the region with particular reference to their impact on the economic development programmes of the countries in the Colombo Plan region;

(3) to focus the attention of member governments, and also the public, on the importance of intra-regional training, and thus help to develop an adequate awareness of the problems involved;

(4) to seek the co-operation of national and international agencies in promoting intra-regional training;

(5) to secure the more effective use, on a regional basis, of those training facilities available in each host country by arranging for delegates to acquire a first-hand knowledge of these through visits to training institutions and industrial establishments.

The discussions at the Colloquium centred around the following three main areas:

(i) Influence of technician education on economic development;

(ii) How the status of technicians could be improved

(iii) Identification of areas of research and innovation

The following Working Papers were prepared by expert Consultants and provided the basis for discussion at the Colloquium:

(i) **"The Influence of Technician Education on Economic Development"**
by Mr. Ainuddin bin Abdul Wahid

(ii) **"Improving the Status of the Technicians"**
by Mr. Bashir A. Parvez

(iii) **"Improving the Status of Technicians"**
by Brigadier General A. B. Connelly

(iv) **"An Analysis of Major Issues Involved in Planning and Implementation, and Identification of Main Areas of Research and Innovations"**
by Dr. L. S. Chandrakant.

The Colloquium was attended by 39 delegates from Bangladesh, Britain, Canada, Fiji, India, Indonesia, Iran, Japan, Republic of Korea, Laos, Malaysia, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka and Thailand and five observers from Australia, Colombo Plan Staff College for Technician Education, Commonwealth Secretariat, ILO and Unesco. Mr. I. K. McGregor, Director, Colombo Plan Bureau and Mr. Ainuddin bin Abdul Wahid, Vice-Chancellor, University of Technology, Malaysia, Kuala Lumpur, served as Co-Chairman of the Colloquium.

As an important part of the Colloquium the delegates were taken on visits to—

(i) National Operations Room.

(ii) Pewter and Batek Factories.

(iii) University of Technology.

(iv) Telecommunication Training Centre.

Each delegation had been requested to prepare and bring with it answers to a Questionnaire circulated by the Colombo Plan Bureau. A Session was devoted to the presentation of each country's answers to the Questionnaire The answers, which are reproduced in this report, would be very valuable in gaining insight in the development of technician education and training in the region.

An important recommendation made by the Colloquium for consideration and appropriate action by member governments was that the countries in the region should aim at developing progressively sustaining systems of technician education and training to suit their particular socio-economic needs. The Colloquium recognised that the status of the technician who has an important functional role in the process of economic development of any country should be improved. The Colloquium also called for active co-operation between institution and industry and felt that the concept of shared responsibility should be a cardinal feature of any system of technician education and training. Another important recommendation of the Colloquium was that research should be undertaken to ensure that technical education and training were related to the socio-economic needs of the Colombo Plan region. These needs hold practical problems both in individual countries and groups of countries. Research into these problems which arise in the latter should be undertaken as a matter of priority by international organisations and the Colombo Plan Staff College for Technician Education.

The draft text of the Colloquium Communique was prepared by a Drafting Committee consisting of Mr. I. K. McGregor, Mr. Ainuddin bin Abdul Wahid. Mr. J. L. Cabot, Dr. Aminul Huq, Mr. Koh Watt Seng, Mr. Ananta Krukeo, Mr. S. Mahendra, Mr. Meli Maisema, Mr. V. Murugasu, and Mr. M. S. Srinivasan.

The proceedings were tape-recorded and this report contains a summary of the discussions. It is hoped that it will be of use to international organisations, governments, training agencies and individuals interested in technical education and training in the region.

ACKNOWLEDGEMENTS

The Colombo Plan Bureau wishes to place on record its sincere appreciation for the excellent co-operation it received from a number of persons and institutions who helped in so many ways to make the Colloquium a success. Particular thanks are due to:

(1) Hon. Dr. Mahathir bin Mohamad, Minister of Education, Malaysia, for delivering the Inaugural Address.

(2) Tan Sri Haji Hamdan bin Sheikh Tahir, Director-General of Education, Malaysia, for delivering the Welcome Address.

(3) The Government of Malaysia for permitting the Colombo Plan Bureau to stage the Colloquium and for extending the hospitality to the delegates.

(4) The Secretary-General, Ministry of Education and Mr. Nik Ahmad bin Haji Nik Hassan, the Bureau's National Correspondent for Intra-Regional Technician Training, for their active support and assistance in staging the Colloquium.

(5) Mr. Ainuddin bin Abdul Wahid, Dr. L. S. Chandrakant, Brigadier-General A. B. Connelly and Mr. Bashir A. Parvez, the Consultants who contributed working papers and took an active part in the proceedings.

(6) All the participants, both country delegates and observers from international organisations.

(7) Representatives of Missions of Colombo Plan Countries in Kuala Lumpur and other distinguished invitees for attending the Inaugural Session.

(8) Mrs. Freida binti Datuk Mohammad Pilus and her staff in the Secretariat for the signal services they had rendered towards this Colloquium.

(9) Members of the Organising Committee and Drafting Committee; the people who worked so well the Public Address System; those who made the hotel arrangements; those who conducted on the various visits and tours and all those who worked behind the scenes to make this meeting run so smoothly.

(10) All those who are in charge of the industries and institutions that were visited.

(11) The people who were in charge of the publicity arrangements; the Malaysian T.V., Radio and Press for the excellent coverage they had given to this Colloquium.

(12) Mr. Y. Saran, Principal, Technical Teachers' Training Institute, Bhopal, author of Background Paper for permitting the full publication and use of his paper which provided excellent background reading.

COLLOQUIUM PROGRAMME

Monday, 21st April

08.30 hours Registration of Participants.

09.45 hours **INAUGURAL SESSION**

Welcome Address by Tan Sri Haji Hamdan bin Sheikh Tahir, Director-General of Education, Malaysia.

Address by Mr. I. K. McGregor, Director, Colombo Plan Bureau.

Inaugural Address by the Honourable Dr. Mahathir bin Mohamad, Minister of Education, Malaysia.

(Refreshments)

11.00 hours **SESSION ONE**

"The Influence of Technician Education on Economic Development" by Mr. Ainuddin bin Abdul Wahid, Vice-Chancellor, University of Technology, Malaysia.

Discussion on Mr. Ainuddin's Paper.

12.30 hours (Lunch)

14.30 hours Visit to National Operations Room: Briefing by an officer from the Implementation Co-ordination Development Administration Unit.

20.00 hours Dinner Reception by Director, Colombo Plan Bureau, at Hong Kong Room, Hilton Hotel, Kuala Lumpur.

Tuesday, 22nd April

08.30 hours **SESSION TWO**

"Improving the Status of Technicians"

by (i) Mr. Bashir A. Parvez, Director of Technical Education, Government of the Punjab, Lahore.

(ii) Brigadier-General A. B. Connelly, Colombo Plan Adviser (Project Development), Foreign Economic Relations Department, Rangoon.

10.00 hours (Coffee)

10.15 hours Discussion on Mr. Parvez's and Brigadier-General A. B. Connelly's Papers.

11.00 hours	**"An Analysis of Major Issues Involved in Planning and Implementation, and Identification of Main Areas of Research and Innovations"** by Dr. L. S. Chandrakant, Director, Colombo Plan Staff College for Technician Education, Singapore. Discussion on Dr. Chandrakant's Paper.
12.30 hours	(Lunch)
14.00 hours	Visits to Pewter and Batek Factories.

Wednesday, 23rd April

08.30 hours	**SESSION THREE** Discussion on Questions Arising from Working Papers.
10.00 hours	(Coffee)
10.15 hours	Discussion (continued).
12.30 hours	(Lunch)
Afternoon	Free
20.00 hours	Dinner Reception by the Honourable Minister of Education, Malaysia, Dr. Mahathir bin Mohamad, at Malacca Terrace, Regents Hotel, Kuala Lumpur.

Thursday, 24th April

08.30 hours	**SESSION FOUR** Presentation of Answers to Colloquium Questionnaire by Member Country Representatives.
10.00 hours	(Coffee)
10.15 hours	Presentation of Answers to Colloquium Questionnaire by Member Country Representatives (continued).
12.30 hours	(Lunch)
14.00 hours	Visits to University of Technology and Telecommunication Training Centre.

Friday, 25th April

09.00 hours	**CONCLUDING SESSION**
	Consideration and Adoption of Colloquium Communique.
	Closing Speeches.
10.30 hours	(Coffee)

Saturday, 26th April

09.00 hours	**POST COLLOQUIUM TOUR TO FRASERS HILL**
	Briefing and Visit to Places of Interest in Frasers Hill. Lunch at Sri Pahang. Visit to Waterfall and Cattle Rearing Project. Visit to Nursery and Jungle Walk. (Frazers Hill is a Hill Resort which is a Two Hour Car Ride from Kuala Lumpur. It is about 3,000 feet above Sea Level).

LIST OF DELEGATES AND OBSERVERS

Co-Chairmen

Mr. I. K. McGregor —Director,
Colombo Plan Bureau.

Mr. Ainuddin bin Abdul Wahid —Vice-Chancellor,
University of Technology,
Kuala Lumpur.

Consultants

Mr. Ainuddin bin Abdul Wahid —Vice-Chancellor,
University of Technology,
Kuala Lumpur.

Dr. L. S. Chandrakant —Director,
Colombo Plan Staff College for Technician Education,
Singapore.

Brigadier-General A. B. Connelly —Colombo Plan Adviser (Project Development),
Foreign Economic Relations Department,
Rangoon.

Mr. Bashir A. Parvez —Director,
Technical Education,
Punjab,
Lahore.

Country	*Name*	*Designation and Address*
BANGLADESH	Mr. M. Muhiuddin	Chief, Technical Assistance Programme, External Resources Division, Ministry of Planning, Bangladesh Secretariat, Dacca.
	Mr. Bidhu Bhusan Sen	Principal, Technical Training Centre, Dacca.
	Dr. Aminul Huq	Deputy Chief, Industries Division, Planning Commission, Dacca.
BRITAIN	Dr. Ralph C. Skelton	Adviser on Technical Education Development Division, British Embassy, Bangkok.
FIJI	Mr. Meli Maisema	Principal Education Officer, Ministry of Education, Youth and Sport, Suva.
	Mr. K. H. Subramanium	Head of School, Derrick Technical Institute, Suva.
INDIA	Mr. M. S. Srinivasan	Deputy Educational Adviser, (Tech.) Ministry of Education, New Delhi.
	Mr. M. S. Garudachar	Director of Training (D.G.E. &T.) Ministry of Labour, New Delhi.
INDONESIA	Engineer Winnetou Nowawi	Chief, Division of Technical Education Department of Education and Culture, Djakarta.

Country	*Name*	*Designation and Address*
INDONESIA	Mr. Wahyudi Ruwiyanto	Regional Inspector of Technical Education in South Sulawesi, Ujung Pandang.
IRAN	Mr. Houshang Ghaeli	Technical Deputy, Bureau for Secondary Course Education, Ministry of Education, Secondary School Department, Teheran.
	Mr. Mohammad Rabieh	Acting Projects Director, Vocational and Technical Education Centre, Ministry of Education, Teheran.
JAPAN	Mr. Kazuya Sadachi	First Secretary, Embassy of Japan, Kuala Lumpur.
REPUBLIC OF KOREA	Mr. In-Hwan Kim	Assistant Chief, Co-ordination Division, Technical Co-operation Bureau, Ministry of Science & Technology, Seoul.
	Mr. Shin-Bok Kim	Senior Researcher, Korean Educational Development Institute, Seoul.
LAOS	Mr. Phonekeo Khammone	Director of Training Centre, Electricity of Laos, Vientianne.
	Mr. Chanthaphasouk Khamphovi	Head, Administrative Section, Department of Technical Education, Vientiane.

Country	*Name*	*Designation and Address*
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	Mr. V. Murugasu	Deputy Director, Technical & Vocational Division, Ministry of Education, Kuala Lumpur.
	Mr. Mohd. Tahir Majid	Acting Director, MARA Institute of Technology, Shah Alam.
	Mr. K. Pathmanathan	Lecturer, Politeknik Ungku Omar, Ipoh.
	Mr. Mohd. Wahiduddin bin Abdul Wahab	Director, Industries Sector, I.C.D.A.U., Prime Minister's Department, Kuala Lumpur.
	Mr. Abdul Rahim bin Busu Mat Nor	Assistant Director, Technical and Vocational Division, Ministry of Education.
	Mr. Mohamed Rafik Khan	Assistant Director, Technical & Vocational Education Division, Ministry of Education.
	Mr. Rosti bin Saruwono	Principal, Industrial Training Institute, Ministry of Labour & Manpower, Kuala Lumpur.
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	Mr. Ezrin Arbi	Senior Lecturer, School of Architecture, Planning & Surveying, MARA Institute of Technology, Shah Alam.
	Mr. Mohamed Thalha	MARA Institute of Technology, Shah Alam.
	Mr. Toh Weng Fook	MARA Institute of Technology, Shah Alam.
	Mr. Mohd. Nawi b. Salleh	Lecturer, School of Engineering, MARA Institute of Technology, Shah Alam.
	Mr. M. Sukhi Sayuti	Principal, Youth Training Centre, Dusun Tua.
	Mr. Ung Cheng Pee	Senior Lecturer, MARA Institute of Technology, Shah Alam.
NEPAL	Mr. Manik Lal Manandhar	Under-Secretary, National Planning Commission Secretariat, Kathmandu.
	Mr. Subarna Man Joshi	Acting Under-Secretary, Ministry of Education, Kathmandu.

Country	*Name*	*Designation and Address*
PAKISTAN	Mr. Masood Ali Khan	Section Officer, Economic Affairs Division, Islamabad.
PAPUA NEW GUINEA	Mr. Joseph Saruva	Superintendent Operations, Technical Department of Education.
	Mrs. Wilhelmina Siaguru	Research Officer, Public Service Board, Central Government Office, Waigani.
PHILIPPINES	Mr. Bayani I. Gutierrez	Vice-President Philippine College of Arts, and Trades, Manila.
	Mr. Andres R. Asistin	Director of Vocational Education, Department of Education, Manila.
SINGAPORE	Mr. Koh Watt Seng	Divisional Director/Institutions Training, Industrial Training Board, Singapore.
	Miss Ann Chiang	Administration Officer, Industrial Training Board, Singapore.
SRI LANKA	Mr. M. A. Mohamed	Additional Director of External Resources Division, Ministry of Planning and Economic Affairs, Colombo.
	Mr. R. Paskaralingam	Additional Secretary, Ministry of Education, Colombo.

Country	*Name*	*Designation and Address*
THAILAND	Mr. Ananta Krukeo	Director, Vocational Teachers' College, Bangkok.
	Mr. Kriengkrai Issara-Yangyun	Economist, Department of Technical & Economic Co-operation, Bangkok.

Observers

AUSTRALIA	Mr. Neil Richardson	Second Secretary, Australian High Commission, Kuala Lumpur.
COLOMBO PLAN STAFF COLLEGE	Mr. J. L. Cabot	Organising Tutor, Colombo Plan Staff College for Technician Education, Singapore.
COMMON-WEALTH SECRETARIAT	Mr. P. D. Snelson	Assistant Director, Commonwealth Fund for Technical Co-operation, Commonwealth Secretariat, Marlborough House, London.
ILO	Mr. R. La Serra	Vocational Training Officer, ILO Asia Regional Department, Bangkok.
UNESCO	Mr. F. J. C. Pala	Deputy Director, Unesco Regional Office for Science and Technology for South-East Asia, Jakarta.

Colombo Plan Bureau Officers

Mr. I. K. McGregor	Director
Mr. S. Mahendra	Special Assistant to the Director
Mr. C. Pathmanathan	Secretary/Accountant

INAUGURAL SESSION

WELCOME ADDRESS

by

TAN SRI HAJI HAMDAN BIN SHEIKH TAHIR
Director-General of Education
Malaysia

It gives me great pleasure to welcome all of you, ladies and gentlemen, to Malaysia and to the Sixth Colloquium on "Intra-Regional Technician Training".

We are happy that Malaysia has been chosen as the venue for the Sixth Colloquium, for I am sure that the Colloquium will give additional impetus to our Government's plans for the further development of technician education and training in this country. Further this Colloquium will undoubtedly highlight its importance in actively promoting economic and social developments in other developing countries.

I believe five other Colloquia have been held in member countries of the Colombo Plan region since 1965 and this is the Sixth. In each of the Colloquia, different aspects of technician training have been discussed, and in this one, the problems relating to the training of technicians and the need for intra-regional training will be among the main topics to be discussed.

It is my hope that you will find the technician education and training facilities available in this country, and the problems encountered in our developing them are of some interest to you, and will provide some useful material for discussion and study.

I do hope that the arrangements made for the Colloquium and for your stay and your visits are in order and that while your deliberations are successful, your stay in our country will also be pleasant and enjoyable.

Malaysia is also going through the same difficulties that face developing nations. We are also aiming at developing our economy rapidly. For this purpose we are developing our industries and commerce, improving agriculture and the administration of the country.

To this end the educational system has been geared to meet trained manpower needs of the country.

Pupils at the end of the sixth year are exposed to taking up effective subjects, such as Industrial Arts, Agricultural Science, Commercial Studies and Home Science, so that at the end of the ninth year they will have some basic knowledge in the practical subjects.

Our vocational schools produce workers at the craftsman level. The technical schools prepare students for tertiary learning in technical areas. Mid-level workers or technicians are trained in the Polytechnics. We have one polytechnic with about 2,000 students, and a new one will be built next year in Kuantan which will cater to a similar number when fully operational.

The Ministry of Education, cognizant of the importance of technical and vocational education plans to build more vocational and technical schools in the next few years. We realise that a sound and flexible educational system is a prerequisite for the supply of trained manpower especially at the mid and upper levels. Attention is being given to improving general, vocational and technical education for the young pupils who represent the labour force of the future.

The problems faced by our institutions in the country are manifold, but I like to mention just two for your consideration later. Firstly, how to train our technicians so as to provide them with maximum theoretical and practical contents both in the institutions and in plant? Secondly, how best can we involve industries in our training programmes? These are, no doubt, questions of interest to all of you, for I am sure these are problems that are facing not only Malaysia but also all other developing countries as well.

Another topic which I like to mention briefly, and which I note, is also a subject of your discussions is intra-regional co-operation. As developing countries do not have the resources or the capacity for organising technician training programmes; co-operative effort on an intra-regional basic seems to be the answer. This will also lead to greater utilization of available expertise and resources, notwithstanding specialization and economy. I can see a number of areas where intra-regional co-operation is possible, but Malaysia will be very interested particularly in on-the-job training facilities for technical educators.

I now wish to conclude by saying once more how happy I am to welcome each and everyone of you from different countries to this country of ours in general, and to this Colloquium in particular.

No doubt, every one of you brings with you a wealth of experience, expertise, knowledge and wisdom that you will be willing to share with one another, and thus enrich and benefit all of you as a whole.

This Colloquium provides a platform for a frank exchange of views on problems common to all our countries, and I trust you will all participate fully and energetically so that the problems can be identified and the solutions studied and discussed for implementation.

I hope through your discussion, you will be able to realise the objectives and the purposes for which the Colloquium has been convened, so that at the end of the deliberations all of us will have benefited immensely.

ADDRESS

by

Mr. I. K. McGregor

Director, Colombo Plan Bureau

May I begin by welcoming you all to this Sixth Colloquium on "Intra-Regional Technician Training" sponsored by the Colombo Plan Bureau and held in Kuala Lumpur with the assistance of the Malaysian Government. This is the sixth of the series of such meetings, the previous ones having been held in New Delhi, Bangkok, Singapore, Manila and Karachi.

The main objectives of this Colloquium are to focus attention on the training of middle-level technicians and to explore ways in which, in the Colombo Plan context, their development could best be undertaken. We are gratified that most member countries of the Colombo Plan and three international organisations have sent delegations to this meeting and we hope that, as in previous Meetings, a fruitful exchange of experience and ideas would ensure among them.

These Colloquia are held every two years as an important activity of the Intra-Regional Technician Training Programme which has now been in operation for a little over ten years. This programme has two important aims:

(i) to encourage the development of manpower at the technician or middle-level, and

(ii) to promote the use by all member countries of the technician training facilities available within the Colombo Plan region.

In addition to these Colloquia, the Bureau also sponsors National Seminars, of which 14 have been held so far on different themes, and also Country Workshops, the first of which was held last year in the Philippines on the theme "New Directions in Vocational Guidance".

While the follow-up and implementation of recommendations which emerge from these meetings are exclusively matters for the governments concerned, I would like to refer here to an important regional activity that was the direct outcome of a Colombo Plan Colloquium held many years ago. I am referring to the Colombo Plan Staff College for Technician Education which was established in Singapore last year. The Staff College, which came into operation after six years of study and deliberation by member governments, is designed to assist regional member countries of the Colombo Plan in the improvement of the quality of technician education and training and to that end:

(i) undertake programmes in staff development and training, and development and research,

(ii) serve as a regional forum for discussion; and

(iii) provide an advisory and resource service.

The Staff College conducted its first course—which was a Study Conference for Senior Administrators of Technnical Education—a few weeks ago and we are fortunate to have with us the Director of the College, Dr. L. S. Chandrakant, and also one of the Visiting Specialists, Mr. Bashir Parvez, Director of Technical Education, Punjab, Pakistan and Brigadier Alan Connelly my predecessor as Director of the Bureau, all of whom will be presenting Papers at this Colloquium.

I should like to take this opportunity to say a few words about the Colombo Plan. The Plan has been in operation since 1951 and next year it will be celebrating its 25th Anniversary. The Plan's membership has grown from the original 7 to 27 and the indications are that more countries will join in the next few years.

The Colombo Plan is unique among international organisations and the prestige that it enjoys may be attributed to a number of factors. The most important amongst these is that all aid under the Plan is negotiated bilaterally on a government to government basis whereby the sovereignty and sensitivity of member countries are respected. The absence of a centralised Secretariat, the flexibility and speed of operations, the informality of the annual Ministerial Meetings and the fact that decisions are taken on a basis of consensus rather than on that of votes are all important features which have made the Plan popular amongst both donors and recipients. A fund of goodwill has been created and the Plan continues to play its role perhaps somewhat too unobtrusively but certainly with lasting effect.

Since 1951, 8003 training and student places have been provided under the Colombo Plan by countries in the region and 6596 training places have been provided within the region under third country training programmes sponsored by countries outside the region. Malaysia, providing 168 training places to nationals of other regional countries since joining the Plan in 1957, has contributed its share to intra-regional training. While these figures are most heartening and there is reason to believe that the excellent training facilities available in the Colombo Plan region are being utilised by neighbouring countries, it should be pointed out that intra-regional training constitutes only eight percent of the total training provided under the Plan.

For this Colloquium we have selected three areas around which we plan to centre our discussions. They are:

(i) The influence of technician education on economic development, both long-term and short-term;

(ii) Improving the status of technicians; and

(iii) Research and Innovation in Technician Education.

Discussion on the first topic would centre around a Working Paper presented by Mr. Ainuddin Abdul Wahid, Vice-Chancellor, University of Technology. For the second topic, we have two Papers, one presented by Mr. Bashir A. Parvez and the other by Brigadier Alan Connelly from Canada. For the third topic, we have a Paper by Dr. L. S. Chandrakant, Director of the Colombo Plan Staff College.

We are glad to have had the opportunity of arranging this Colloquium in Malaysia. I might mention here that this is not the first occasion on which Malaysia is acting as host to a Colombo Plan Meeting. In 1961, four years after the then Federation of Malaya joined the Colombo Plan, the Consultative Committee had its Annual Meeting in Kuala Lumpur. In 1970, the Colombo Plan Bureau co-sponsored with the Malaysian Government a National Seminar on the theme "National Planning of Vocational and Technical Training". Last week a National Workshop was held in the Genting Highlands on Narcotics Control. This Colloquium then is the fourth occasion on which a Colombo Plan activity is being held in this country.

Malaysia has an enviable record of achievement in economic and social development. We are all aware of the importance which the Malaysian Government attached to orderly planning and symbolic of this is the National Operations Room which is so well known among the countries of the region. As part of the programme for the Colloquium it is proposed to take delegates on a visit to the National Operations Room. We also hope to show the delegates a few institutions and industries such as those producing traditional batik materials and pewter. These could provide examples of the kind of technical education and industrial enterprises which would offer a wide range of training opportunities appropriate to accelerate development.

Our task of arranging this Colloquium has been facilitated by the excellent support that we have received from the Secretary-General and other officials of the Ministry of Education. I would like to thank in particular Mr. Haji Lokman bin Musa and his colleagues who have spared no pains in making arrangements for what should be a useful and stimulating meeting.

I now have great pleasure in calling upon the Honourable Dr. Mahathir bin Mohamad, Minister of Education, to inaugurate the Colloquium.

INAUGURAL ADDRESS

by

Honourable Dr. Mahathir bin Mohamad
Minister of Education
Malaysia

It gives me great pleasure that the Colombo Plan Bureau has chosen Malaysia as its venue for the Sixth Colloquim on "Intra-Regional Technician Training". I am very happy to welcome to Kuala Lumpur the distinguished delegates and observers who will be participating in this Colloquium.

Malaysia, while contributing towards the Colombo Plan in its own small way has received much aid from the more industrialised member countries. We have received aid in the field of technical and vocational education in the form of expert personnel, scholarships, training awards and equipment.

We are grateful for the aid given to us by several countries especially Australia, Britain, Canada, Japan and New Zealand and such aids have helped to expand technical and vocational education in our country. Training places have been made available to our technical teachers and lecturers, and this has enabled us to increase trained technical personnel to man the increasing number of schools providing technical education.

These technical schools and colleges are of prime importance to us as a developing country with a rapid industrialising programme. It is a well accepted thesis that skilled manpower determines a nation's economic development. This is borne out by the progress achieved by a number of underdeveloped countries which have successfully developed their skilled manpower.

Malaysia while requiring aid to develop its skilled manpower is willing to make contributions in order to help other nations in any way possible. We believe that it is only through inter-regional and intra-regional co-operation that the developing countries of South and South-East Asia can achieve economic development.

I understand that the Sixth Colloquium on "Intra-Regional Technician Training" will discuss, among other things, the influence of technician training on economic development, the status of the technician, and the major issues involved in planning and implementation.

In recent years there has been much discussion on the problems connected with the development of human resources and the planning of technician education and training as is evidenced by the fact that this is the third Colloquium on this subject during this month, one having been held in Singapore and another in Manila.

These are important and very relevant topics especially as there is a great emphasis on planned economic development among countries in this region.

It is realised that progress in developing countries is dependent on the rate of economic development and human resources are a key factor in economic development. Economic development cannot take place unless there is an increase in the supply of trained and qualified personnel.

Large capital investments in themselves are of no use if countries do not produce sufficient skilled manpower. Educated and trained men are needed to man the factories and participate in business and also to guide the governments in numerous enterprises and efforts.

It is fitting that the Colombo Plan Bureau has put much emphasis on the subject of the human resource factor in economic growth, for clearly this factor determines the rate of economic development. The economic resurgence of West Germany and Japan after the war is largely due to their ability to produce rapidly an army of technically skillful and able personnel capable of manning a rapidly expanding industrial economy.

Many of the problems of under-development in the countries which are endowed with rich natural and physical resources, are due to the lack of proper development and utilization of human resources. It is for this reason that we see the paradox of countries with rich natural resources continuing to be underdeveloped while those poor in resources attain economic development and power. It would seem upon analysis that natural resources is not as important as skills in development. And the skills of the technician are becoming increasingly recognised as crucial in a technology-dominated world.

The technician who provides the link between the professional at the top and the craftsmen at the other end is the backbone of any industry as technology becomes more complex and diverse. Technicians are able to relieve trained professionals, who are perpetually in short supply for routine work of a supervisory nature and help to improve the quality and efficiency of production.

It is only right that more and more thought be devoted to the problems of technicians development and their relationship with the progress of developing countries. On our ability to tackle these problems rests the fate of developing nations.

This Colloquium is of great significance to us and I am sure to the other countries of this region. Malaysia has embarked on a rapid industrialisation programme. This has created a great need for professionals, technicians and skilled craftsmen. To meet these national demands we have launched a massive educational and training programme at all levels. There are three institutions that provide professional and sub-professional educational and training programmes. We established a Polytechnic with UNDP/Unesco aid in 1969 to train technicians, and another such polytechnic is at an advanced stage of planning. Technical and vocational education is provided to our boys and girls in specially equipped schools. The eight technical schools provide an introductory course in technical subjects to students who will eventually go to universities, colleges and polytechnics. The Vocational Schools, numbering 20 at present, provide training in various skills with a component of general education. These schools turn out craftsmen for the nation's industries. In order to create an interest in technical and vocational training, students are taught Industrial Arts as a subject in the first three years of secondary education. A great deal of interest and keenness has been shown both by the students and parents in this subject and every year more workshops are built and equipped to ensure that every pupil will be able to study this subject at school.

To ensure the success of all these educational and training programmes, Malaysia welcomes assistance of any kind from any source. We have our share of problems and we have questions to ask. Solutions to these problems and answers to these questions would be most welcome. The questions that immediately come to mind are: How do we change the attitudes of people used to the traditional, academic kind of education? How do we ensure that there will be sufficient skilled manpower in a particular field while ensuring that every trained and skilled person finds employment in his particular field? What are the best methods of training technicians and skilled workers to meet the urgent needs of a rapidly expanding industrialisation programme while keeping the costs within the financial capacity of the nation? How do we keep up training and diversify it to keep up with the rapid advancements made in technology?

Answers to these and many more questions will, I hope, come to light during the deliberations that will take place here. These would be of great interest, not only to us, but also to many others as well.

Finally, it is my hope that you will find some time to visit the very many places of interest in Kuala Lumpur and in other parts of Malaysia both during and after the Colloquium so that when you return to your countries you will take with you not only the many ideas and solutions arising from your discussions, but also pleasant memories of the peoples and places of this land of ours.

I wish you ladies and gentlemen every success in your deliberations.

Now, it gives me great pleasure to declare the Colombo Plan Bureau's Sixth Colloquium on "Intra-Regional Technician Training" open.

SESSION ONE

CHAIRMAN: Mr. I. K. McGregor

THE INFLUENCE OF TECHNICIAN EDUCATION ON ECONOMIC DEVELOPMENT

by

Mr. Ainuddin bin Abdul Wahid
Vice-Chancellor
University of Technology
Kuala Lumpur

Introduction

Realizing that technician education is essentially indigenous, the discussion in this paper will be based generally on the Malaysian experience of the subject. It is important to realise that no system of technician education can be transplanted or imported into a developing country with an assurance of success as the system has been in the original country. Technician education, for that matter any system of education, must necessarily be so designed to suit the particular need of a country. However, it is also noted that in many areas of technician education, the other developing countries are also facing the problems that are confronting Malaysia.

The Technician

As the term 'technician' may have varying connotations, it is proposed to adopt in this paper the definition recommended by Unesco and the ILO. The recommendation says:

> "The term 'technician' applies to persons working in occupations requiring a knowledge of technology and related sciences between that of a skilled worker and that of an engineer or technologist; occupations at the technician's level may call for inspection and maintenance, detailed development plans, supervision of production work, detail construction. Collaboration with the engineer is an essential part of the work of the technician".

In other words, he is the important link between the engineer or the technologist and the skilled worker. A technician should posses enough practical skill to enable him to appreciate the problems of the skilled workers in their workshop or at their construction site; at the same time his theoretical training should enable him to understand the ideas of the engineer or technologist and to interpret those ideas to the skilled workers. In short, a technician must not only know how a job is done, but he must also know why it is done in that way. He is a distinct type of technical worker, without whom the efficiency of a project will be affected adversely.

The Important Role of Trained Manpower

Having defined 'the technician', it is appropriate now to establish his role in the economic development of a country. Today, in Malaysia. there is a growing realisation that trained manpower is a very important factor in the national economic development programme. It is also realised that having natural resources alone is not a necessary nor a sufficient condition for economic development. The economic recovery of Japan after the Second World War shows clearly that the most important factor determining the rate of economic development is trained manpower and not natural resources.

Shortage of Trained Manpower in Malaysia

The important role of trained manpower in economic development has been very evident in this country during the last few years. The short-fall in the public construction projects during the First Malaysia Plan period, 1966-1970, was partly due to the shortage of trained personnel, namely engineers and technicians. Now the Public Works Department has to employ engineers from other countries to improve the situation. Lately, when oil was found off the shores of Malaysia, it suddenly dawns upon us that there is hardly any supply of manpower trained in the oil industry to tap from. Thus unless foreign technical personnel are imported, the much sought after natural resource will be left unexploited for some time. Thus it can be concluded that trained manpower is a very necessary factor in the economic development of any country, be it industrial or agricultural, developed or developing.

The Important Role of Technicians

By the definition stated earlier, the technician belongs to the group of trained manpower. The fact that he is the link between the engineer or technologist and the skilled worker makes him the more so important in economic development. Thus it is indeed obvious that the education of such a personnel—technician education—will have strong influence on the economic development of any country. However, it must be realised that economic development does not necessarily follow indiscriminate expenditure on technician education.

Requirements of Technician Education

To elucidate further the influence of technician education on economic development, it is necessary for us to study the various factors that should be considered in planning technician education. Initially we all know that an education system is only as good as its teachers. Poorly trained teachers mean poorly trained students. But it is a common factor in all developing countries that good technician teachers are not readily available. We are facing this problem now in Malaysia. There may be some experienced technicians and keen, young engineers or technologists but they may not be interested in becoming technician teachers. Even if there are those who are interested in teaching, then they certainly have no know-how of teaching and the young engineers or technologists will also be lacking in technical experience. Therefore training will be necessary and it will certainly take time. Thus it is imperative that before the implementation of any technician education programme, an adequate supply of suitably trained technical teachers must be made available.

Now we shall consider the technician education programme itself. First we must ascertain the immediate needs of the economic development plan with respect to the number of technician required and also their specialization. Then a special programme—a crash programme—to meet the immediate needs should be specially designed and implemented quickly. The possibility of using any other available and existing facility for the training of technicians should be examined. At the same time the projected needs over the economic development plan period and subsequently the long term needs should be worked out quantitatively as well as qualitatively. The phasing and order of priorities of the various types of technician education programmes should then be established and the detail programmes developed.

A basic consideration that should be observed in developing technician education programmes is to design all the programmes such that they will form an integral part of a comprehensive and integrated system of technical education for the country. The programmes should also be flexible and broad-based. In turn, the technical education system must form an integral part of the overall education system of the nation. Indeed it may not be out of place here to note that,*

> "The days of technical education as a separate entity are over. It must now merge into the whole educational structure if education is to be adapted to the modern world."

Having developed and implemented the technician education programmes, it is important that the supply and demand relationship of technicians be kept continuously under review. This will enable us to detect quickly any modification or change that may be required. It will also ensure that the technician education programmes are up-to-date at all times. However, it must also be realised that with the rapid development in technology, even the experienced technicians will have to attend training programmes from time to time. This is necessary to enable the technicians to keep abreast of new methods and materials. It is also consistent with the concept of life-long education.

Conclusion

The experience of many countries, developed or developing has established that the technically trained manpower which includes the technician is a very important element in the field of economic development. No country which is development-oriented can afford to be without or even short of technicians. A special and an intensified programme of technician education will produce the urgently required technicians relatively quickly. To suit the local conditions and stage of development, a technician education programme must be indigenous. No education programme will produce the desired results if the teachers are badly or poorly trained. With the rapid expansion of technical knowledge, technician education programmes must necessarily be flexible so that they can be amended and up dated in accordance with the development of technology.

The above points enable us to conclude positively, that technician education has great influence on the economic development of a nation. The above, in brief is the Influence of Technician Education on Economic Development, both Long-Term and Short-Term.

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*Hugh Warren, Vocational and Technical Education, Unesco, Paris, 1967, p. 175.

Discussion on Mr. Ainuddin's Paper

McGREGOR: Thank you Mr. Ainuddin. I would now open the Paper for discussion.

GUTIERREZ: My attention was caught by the line in the first page "Technician Education, for that matter any system of education, must necessarily be so designed to suit the particular needs of a country". Since we people of South and South-East Asian countries have almost common or similar ways of life, do I understand that the speaker is not in favour of the standardisation of technical education for these countries?

AINUDDIN: Standardisation in technician education should be our objective but when we plan for the technician education programme it would be at different levels of development and it is in this context that I say it should be so designed to suit the particular needs of a country. If we were all developed at the same rate, then we could start the common programme. Our aim is in fact one but because we are at different stages of development then we have to design the education programme—technical education programme as such.

CABOT: The point raised by the distinguished delegate from the Philippines and in fact the way it was answered by Mr. Ainuddin is remarkably close to what has just come out of the Unesco Conference on the establishment and maintenance of technician training in the regional countries associated with Unesco just completed in Manila. The point also relates, I believe, very strongly to one of the ideals of the Colombo Plan Staff College in so far as the offering of what we call country courses is aimed at this way of thinking that an individual country has a particular problem associated with its technician education system. The Staff College would be available to programme, to set up and in fact to operate the course in that country. Such courses will be looking at the individual needs of the country which will not necessarily have any relationship with an individual need in anyone of the other twenty countries of the region associated with the Colombo Plan. To this end the course will be aimed at the appropriate level of technician education in a country. Standardisation for the twentyone countries is just not possible whether it is in curricula or teaching standards, level of input to technician training institutions or level of output. The individual country must come first and there again the Colombo Plan Staff College undoubtedly will be thinking on these lines in the presentation of country courses.

SRINIVASAN: I would confine myself first to specifically agreeing with what the Vice-Chancellor has said about the indigenous technology because it is very well known that whatever be the experience of other countries, the special requirements of each country actually deserves special consideration before any such modification is possible. Any sort of innovation is best done in the vicinity of the point of application. But at the same time, there are a lot of things to be gained even by knowing about the experience of the other countries because even though we may be in different stages of development still there are areas where similar problems at one stage or other occurred in each country. Now, what exactly is the role of a technician. Even though we do agree on some agreed definitions of a technician, we have different views on the tasks performed by a technician when he is employed. So the planning of the manpower requirement, development and utilisation of technicians of any particular country will have to be done with great care. It may not always be easy to identify the areas and also to see how much or what exactly is the requirement of the technicians in any particular field of activity. The second most important point which has been raised in the paper is about the training of teachers for technician education. We have expanded from about 50 polytechnics to about 300 polytechnics over the past two decades in my country. Many a time when the expansion took place we had to recruit teachers whether they had the aptitude or not. It was necessary that we had the teachers and roughly for about 300 polytechnics about 10,000 teachers were required and this was a tremendous challenge to us. During the course of the last decade this problem has been tackled to a great extent by the establishment of technical teacher training institutes. Four such institutes have come up in our country. This particular area of technician teachers' training is something new. This experience in training of teachers for technician education may be shared with others. We do not claim to have been all successful, but we are satisfied more or less at the steps taken in this regard. The other point made in the paper is regarding mixing of general and technician education. Here again the problem is not merely mixing with general education or laying too much emphasis on technician education alone. The problem is that when we do not know what are the requirements of a particular specialised field in technician education a broad-based general education in the technician area itself is required. This was pointed out by the Vice-Chancellor when he mentioned about the Indonesian experiment of training for about 10 months for petroleum technicians. This gives the indication as to what we could attempt of having, different electives in areas where we are not very sure of what we have to do.

AINUDDIN: I agree with most of the points raised by Mr. Srinivasan. I did point out that we do face common problems in developing countries. With regard to the experience of other countries, we should take note of the problems faced by those countries which were more developed than we are and also by other countries similar to ours and not to commit the same mistakes. But unfortunately, this normally comes out only in seminars or collequium like this. We have seen this same mistake being repeated all over again in many countries. I do not know why but it is just so. May be that those who attended the seminars are not the men who control the policy of a particular country. I am sorry to say that now we are realising the importance of trained manpower. The Minister said so but we are still so short of the trained manpower required for our own development. Not that this just comes to us suddenly, no, but as I said I am just sorry that is all. I would not like to say much more, I do not know whether other countries would have better experience than this. About the training of teachers, we have this problems even at the secondary level, we are so short of teachers. One important aspect of teacher training, especially technician teachers, is that they would get a much higher salary in the rapidly developing industry. The Government has got to tie their salary structure to the other people in the public sector but in the private sector the industry will pay a man for what he is worth This is a big problem. Personally I am going to lose one of my most experienced lecturers to industry very soon. I just cannot match the pay he is going to get from the private sector but this is a problem that we have to face and we will be facing this quite a lot. However, one thing I did not mention earlier is the level of training that we should try to attain. I think developing countries should go to the minimum standards possible. Then we may have a bigger supply of people to take from. No doubt it is good to have a high standard of technician education but it will just cost much more in time and money. Further, this will also be an attraction to the private sector to take this people from the training institutions. I say this about the level of technician education programme because in my university, when it was a technical college before, the programme was such that the graduates of the technical college after three years of education, and the students go into the college after secondary education, would be accepted in England even upto today to go into the second year of the three year B.Sc. engineering courses. We find now that we are so short of the higher level technicians because everybody wants to be an engineer as he needs only another two years to qualify himself as an engineer and in the process he will get that much more money in return, that much more prestige in return. So it is very important for us, developing countries, to make sure that the level of training and the level of education of our technical manpower should not be too high. In fact those countries which are just starting industrialisation should aim for the minimum standard possible.

PASKARALINGAM: I am referring to page 6, paragraph 9. The writer has been developing his paper beautifully and after coming to the stage where he emphasises "the phasing and order of priorities of the various type of technician education programmes should then be established and the detail programmes developed" the insertion of paragraph 9 suddenly throws me out a little because I am unable to understand the mind of the author here. It is understandable if it is said that the general education programme in a country should include some sort of prevocational programmes built into the general education pattern in order to develop the attitude of the children towards technical education. But to say that technical education should form part and parcel of general education is not quite clear. I do not know what the author has in mind and also this quotation from Mr. Warren also is misleading to my mind. So I would welcome a little more elucidation as to whether in the Malaysian system the writer has some ideas or programme in mind as to how to build up the technician programme. The technician programme as such is a specialised programme and you need special institutions to develop the programme.

AINUDDIN: Our experience here is that in the lower secondary school education we try to encourage students to take the four electives. Industrial Arts, Agricultural Science, Home Science and Commercial Studies. We feel that by introducing these subjects, as electives at that level, the students would be able to find out in which area he would be interested in. But personally I think it is a bit too much to ask from a child before the age of fifteen. However, this system, called the comprehensive system, is good and in fact our intention originally was to allow the child to select from among the four subjects. Unfortunately, due to lack of teachers and other facilities some schools can offer only two of these four subjects, some even just one so that the child would not have any choice. Even if the child is removed to another place he may have to start on a new subject altogether. It is wrong to ask the arts stream student in the secondary school just to concentrate on the arts subjects because even if he is an arts man he would need to know how to read a plan, for instance.

Possibly when he wants to buy a car or even a motor cycle he must read the specification, if he wants to have a house he must be able to look at the plan of his house and understand what he is going to get from the architect and it is in that context that I say that the days of technical education as a separate entity are over. Because it is a part of our life whether we like it or not, and we must know it, and I feel that the idea of separating the arts of the science or the technical stream students to different schools is not really a wise move because this will maintain the unfortunate attitude of society in most of the developing countries that technical education is not as good as the academic education in the arts stream. This is one problem we have to face. I do not know whether it is so or not in the other countries. We know, for instance, in England the salary of a technician may be very high or at least the gap between the salary of a technologist or engineer and the technician is not that big. But here it is not so and if we can bring them together, and follow this comprehensive system of education right through upto the end of the secondary level then at least they would have a common ground. It is only after that when they reach the age of about 17 or 18 then they would be able to decide whether they should go to one particular area or the other. Whereas if streaming of the student should be done earlier then I think we are being unfair to the children. We should not decide their life and technician education programme is a specialised programme but it should be after the secondary level and it is only then that he should make his decision whether he wants to be a technologist, a technician or go into the other stream. I did say earlier that when we start the technician training programme then we must know the existing education system. If we do not treat technical education as a separate entity, it is easier for us to train the technician.

SEN: We started our first polytechnic institute in the year 1958 borrowing the ideas from a very advanced country, America, and now we have 16 polytechnic institutes in our country but we find now that there is a difficulty of accepting our students by the users. This is because probably the curricular or the training they are receiving is not suitable to the need of our own country. This has now been realised by our government and the new educational policy has recommended for the pre-vocational training right from fifth standard and it will go to 8th standard; from the 8th standard a boy who likes to go for a vocational or technician education will take a subject, technical subject, in his high school study and continue upto 10th grade. After 10th grade, he can go to technical training centre to specialise in a particular trade and to become a skilled technician or he can go to polytechnic and study—3 years course and thereby he can be a supervisory level technician. So this is why we have some pre-vocational arrangement.

WAHYUDI: According to planning technical education what more important do you think to solve the problem such as relevancy, efficiency and effectiveness or to solve the problem like you have mentioned in page 6, paragraph 9 in order to make it an integrated part of the overall education system of the nation.

AINUDDIN: The question of integrating the technician education programme with the overall education programme of the country comes last. We should consider the relevancies and efficiencies initially.

GARUDACHAR: When you say that there should be provision for pre-vocational training I cannot understand why you should reduce technical education to the minimum level?

AINUDDIN: Well if we do not have anything in stock and if we aim high then we will be taking much more time to train a person to reach that high level and it will cost that much more. For instance, we have this example in some of the other countries also—this is about the training of doctors in China. This is what we know about these barefoot doctors. They certainly do not come to the level of doctors in the United States but for the need of China that is adequate. This is, what I am trying to say, to go for the minimum level.

ASISTIN: I fully subscribe to the thesis presented here by the writer of this paper. You see we faced a similar problem in my country, about 10, 16 to 20 years ago. There was a time when a vocational technical education was looked down upon as a form of education for somebody else's children not mine and not yours. So we took a look at the output of our education system and we realised that we were creating an imbalance. There were more lawyers than needed by the national economy, more liberal arts graduates, more commerce students and more teachers. So we instituted a new secondary education programme. This was in effect a work oriented curriculum and is now applicable to all types of schools in our country. We have now an universal type of secondary education programme where practical arts and vocational technical education is the core of the programme. Technician education in my country starts at the post secondary level. We believe that to be able to fully attain technician know-how that the student must have a fair and broad background of a general education that is a broad secondary education programme. I also agree with the statement that technician education should at least maintain some kind of minimum standard in the sense that if we do maintain a college degree for technician education then we would probably be not solving the problem of looking for a technician or technically trained men on this particular level because the tendency is to get a college diploma because even as of now a college diploma is something to be reckoned with, it is a kind of a status symbol. But if we do give some minimum standard for technician education then we would be taking the right men for the kind of job at the middle level in manpower programmes. This is why we should maintain a minimum standard for technician education concomittant with the degree of need in the manpower needs of the developing country like ours.

MAISEMA: I am rather interested with the minimum qualification. Well Fiji is such a small country and our education system copied from another country. It is very difficult to get rid of, in particular when we want to bring in some of the local things that we think is relevant. Because the education system is organised by those people who come from countries who are fairly highly academic, the system follows the academic line right through. The acceptance of these practical subjects within the school system is rather difficult because the principals are highly academic, trained overseas. Further, the parents and some of the students feel that to go into a workshop to do woodwork or metalwork which we call industrial arts is something which is for "no hopers". Inevitably, there are drop-outs which is no good for those who have highly academic minds and can go further either to form five or form six level. We have a big majority who drop-out at form four level. I am talking about the requirements or the entry qualifications which are required by industries. They say the minimum qualification is such and such but because of the academic biased education system there are so many people coming out of the school system with a fairly high academic qualification that the employers develop a tendency to take those with higher qualifications. Take for instance, those who are required as craftsmen or tradesmen; the minimum qualification in our country would be our local examination which is Fiji Junior upto the form four level. Because there are so many who come out, who do not find jobs with higher qualifications, these employers tend to take these people leaving aside those who have this qualification. Most of these people doing this apprenticeship having got the same qualification would like to end up as technicians. It means that there would be no one who would go back and handle the tools. I was interested with the minimum qualification for tradesmen which should of course depend on the aptitude. It is very important to make a good craftsman and make him stay at that particular trade, and not to let him go further or try to get further qualification into technician level. I said at one of our meetings that in Fiji very soon they will be probably advertising for people who have got University education to go and sweep the streets. The employers who come from other countries, may be in the gold mines, may be in the sugar industry, and this sort of things. We mainly concentrate on maintenance, we do not produce things on the mechanical and electrical sides. We only maintain, we do not produce anything of this sort and our worry is that we should keep and try and get these employers to keep their entry qualification to the minimum or to set a maximum qualification in that particular trade.

PALA: There was a question which Mr. Ainuddin raised between difficulty of getting good teachers because of differences in salaries. Industry generally is paying much more than the institutes can pay for their teachers and this point was in some depth discussed also during the meeting last week in the Philippines and if you allow me I would like to read out a general recommendation which came out at this meeting which may be of interest to you also. It says "in view of existing salary differentials between technician teachers and their counterparts in industry it is recommended that the appropriate authorities take action to amend the situation in order to overcome the general expressed problem of recruiting and retaining suitable technician teachers" This is the question which also came up earlier and Mr. Ainuddin was referring to it and I think it is good to mention it here.

KOH: The integration of technical education into the whole education system in the light of the cultural backgrounds from which we have come is about the only way we can bring about a successful technician training programme. Now historically we have all come from societies which gives the status to the person with a clean pair of hands. The king, the ruler, the governor is not somebody who goes round with a pair of spanners in his back pocket. In the post colonial era the success has also gone to the person who have got his degree usually from some foreign university in disciplines completely irrelevant to the requirement of the country. Now how do we bring about a switch? Now in the Singapore experience which is very close to that of Malaysia, we have made it compulsory for every boy entering secondary school and 50 percent of the girls too, to go into basic workshop training. In other words three quarters of the population in the lower secondary schools' first and second years get workshop training. Ultimately, these people may become engineers, lawyers doctors, ballet dancers, concert pianist, but if he is a boy he would have learned how to use a screwdriver, and how to use a file. He would have learned basic electricity in that he knows how the electrical system in his house works. So we are attempting to create a technical orientated society, the results of it are to be seen in that some of our high flyers people with five or six distinctions or potential university material who would in previous years have gone into an university to do a degree will be opting out now from the school system into a technical trade coming up through the apprenticeship system. Some of our most successful apprentices in mechanical engineering trades, metal machining and so forth have been girls. We produced our first pilot instructor, female and I think we might end up still with the captains of our Boeings being women too. This is the experience that we have in Singapore. Now as regards this business of minimum levels of training it is a very interesting concept, frightening to most of the people of the Western orientated countries, where they say, give everybody maximum possible and so we have seen development in some countries where trades schools become technical institutes, technical institutes become technical colleges, technical colleges become technical universities and technical universities end up somewhere in the superlative degree. So countries which cannot afford to dig a ditch end up training nuclear scientists and also we have seen this problem of brain drain, people being over-trained for the requirements of their own country moving out and serving other countries. Should Singapore finance the education of its citizens in order that they can contribute to the development of Great Britain or the United States? We believe also in just training to the levels we require and in that way some of the more ambitious people may feel a sense of frustration and migrate but then the numbers that we lose would not be as disastrous as when we were running several technical universities. We have only three technical colleges in Singapore and one Engineering Faculty in the University and for the time being we are making slow progress not dynamic in terms of one polytechnic ending up as 800 polytechnics but this is the way we think. We suppose this is the basis of training for a country's requirements, for indigenous requirement and not training beyond that. Now in terms of technology being indigenous I feel Mr. Ainuddin's point has been misinterpreted. I do not think he mentioned the technology was indigenous but he said that technician training system should be indigenous. We agree to the transfer of technology. I wonder why most of us from the developing countries look to the technology of advanced countries and we get overwhelmed by solar cells and desalinisation and all that, when we have not paid adequate attention to indigenous technology. I think one of the most fascinating of regional technologies is how they move water up from a low level to a higher level. I think it is a Philippine technology on the terrace farms of the Philippines. Should not we be looking into that instead of importing all this very sophisticated dams and power machines that add to the pollution and result in losing much of the greenery of our country.

AINUDDIN: I have found a strong supporter in the delegate from Singapore. I thank him for that. I think this is our main problem. We generally tend to look how other people are doing things and we do not try what we can do ourselves. Of course it is easier just to copy others but to be more fruitful if we look into our own system, design something to our need and produce something that would be useful for us. He also mentioned just now about trade schools becoming technical institutes and things like that and if this is just to clarify my position, my institute before was a technical college, we were training higher grade technicians and now it is a university but we are still training the technician in fact we are expanding the programme.

ANANTA: The delegation from Singapore mentioned about the problems in technical education involved in many levels. We are facing the same problem at the moment. We have many levels in technician training programmes up to the university programme at the moment and this is what we call social pressure and it is a big pressure at the moment and we do not know how to solve it exactly yet but we are trying. What I would like to ask Mr. Ainuddin about his paper relates to shortage of trained manpower in Malaysia. I would like to know in what degree the Government and private sector are supporting the vocational education in technician training programmes in Malaysia—this would concern about the financing and quality control of the technician training programme.

AINUDDIN: The Government is fully supporting the vocational and technical education programme. This is quite clear from what has been said by the Honourable Minister of Education, just now, but there is a big 'but' in this in that the Minister is not the implementor. Generally, what should be done for Malaysia should have been done a few years ago. Unfortunately, as I said just now, even though Malaysia has been sending delegates to various colloquia there are still some problems which have been before and were still cropping up. This is the human problem that I think we in Malaysia are facing at the moment. We still look towards the Western world for inspiration. This is our mistake and I think in that respect as mentioned by the delegate from Singapore they have done very well I must say and Japan too. We should learn from Japan how they adapt the technologies of the West to their needs. I know but this is a simple example of how they tackle their problems in their highway standards the normal width of the traffic lane in the United States the most developed country in highway engineering is 12 feet, but Japan knowing that their cars are smaller adopt 11 feet as a standard. But many of us would adopt the 12 feet without thinking, thinking that this is the best and that is what we should do. Just imagine on the point of view of cost it is almost 10 percent less. I do not think it needs the university man to think about that but this is our problem. The support from the government as I said just now is very good. I have no problem in getting money from the Government, of course the treasury people will look at it first any way. But from the private sector as has often been said, there may be some problem about giving on the job training. May be because people in the various industries are so busy they have just started with so many teething problems and they may not welcome two or three technicians tagging around asking all sorts of questions but this is changing. Now we have the various big firms sponsoring students to the various institutions and the polytechnics and also to the Faculty of Engineering in the University of Malaysia, into my university and the student would go back to the private firm during the long vacation for on-the-job training and we are getting more support now from the private sector to

[illegible]39

provide this. Though it is still a long way from what we know is happening now less in the United Kingdom, for instance, the sandwich courses and things like that, but we getting some response now, better response than what it was a few years ago.

PASKARALINGAM: I agree with Mr. Ainuddim about a comprehensive pattern of education including some prevocational programmes in the general education in order to improve the inputs into the technician programme. Definitely, the selection of students would be improved if some prevocational and vocational programmes are included in the general curriculum of the schools but apart from improving the intake to the technician programmes this influence of technician education itself on the economic development is a vast area. It covers I suppose several specific programmes but rather than concentrating on one aspect about improving the inputs to the technician programmes. I was wondering why not we concentrate on some of the other aspects of how to make the technician education itself being felt by the countries—in other words there is a lot of confusion when we say technician education in most of the countries, they confuse it with vocational education. Technical education in general, craft level programme, technological programme, they put the entire thing into one and in fact technician training is taken for granted in most of the countries. The technicians as such and their impact on economic development is not specifical and separately felt. I was wondering whether some of the learned delegates here would be able to throw light on some innovations or some developments which they have brought about in their own countries to make the impact of technicians felt on the industry. In other words how the technicians have improved the industrial process—the production process—they have cut down on the cost of production. This is what I was looking for and I do not know whether in Malaysia the writer would be able to identify and give us some programmes which had improved or had markedly made the industry feel the impact of technician programmes itself.

AINUDDIN: When I said that having technical education not treated as a separate entity, I did say at least we will improve the impact of technician training programme but certainly I did not mean that is the only consideration. Our friend from Singapore has clearly shown the importance of giving basic technical training to our children. With regard to the impact of industry, it is quite obvious, that the recovery of Japan after the Second World War is just because they had a number of trained technocrats available and Singapore is another good example, no natural resources but human resources in abundance and highly developed.

SEN: Practical contents of the polytechnic education is such that they are not accepted in our industries particularly some of these private industries. They say that the graduates of polytechnics are neither engineers nor clerks but this could be overcome if they could undergo apprenticeship training. Recently we have had the Apprenticeship Ordinance in our country. We notified the availability of technicians in the 50 industries and the response was only ten but now the situation has been changed because most of our industries have been nationalised and now the government could push and arrange practical training for these boys and if they receive the practical training naturally they will be accepted.

PARVEZ: I just wanted to comment on crash programmes. I would think *that in educational terms crash programmes should be taken with a pinch of salt* because whereas you can have crash programmes in productivity, in agriculture and so on, in educational terms I do not see a short cut to the learning process. It takes its time. I quite understand that it may be inescapable under certain situations so to say when an act of God intervenes for instance, Malaysia striking oil and they being short in oil technicians and oil technologists, but I believe that the quality of a programme especially in the technician education and training that is of utmost importance and if we produce under some kind of a crash programme a half baked person may be we are not serving the cause for which we are actually training and producing him. I relate this point to paragraph 8 of the learned writer's paper where he has brought the need for manpower projection. I think that is the best way in which you can cater to the needs of the future planning programme because I think in a technician training programme a time period of at least 5 to 7 years is needed for planning, for the implementation, teacher recruitment, teacher training and so on. Another point that I want to mention in this need projection is the human factor. Very frequently, very often we talk of the industrial needs, how about the human needs? We in the developing countries are burdened with teeming millions. If we only cater to the immediate for future industrial needs what do we do with the rest of the people. There is also the factor of cultural aspiration. People do not want to become skilled workers, everybody wants to reach the top. Also, in addition to jobs there are other employment opportunities, self employment for instance. Again, since brain drain has become a way of life why not cater to it in developing countries and treat it as a resource and train people for export abroad—some component of it at least not the entire technical education. This matter of projections of manpower needs is rather a complex one and in a particular context in a country it should be viewed from all angles.

AINUDDIN: I agree crash programme is not a good solution but if we need them immediately there is no other way and I say this because this is our experience here. We are so short of teachers we did use those completing their lower secondary education, we train them for another two years and they became teachers at the primary level and I think they have not been a failure though everybody would like to have all the teachers to be graduates of teacher training colleges or universities. As I said just now the special programme has the initial step when you want to have a development programme implemented you do not have anybody to do it. What do you do? You just keep quiet or do you just invite foreigners to come in and pay, may be five times of local wages of a worker. I know it is not very good but given this certain constraint we have to do it. I know it can be done of course before we have a formal training for technicians in this country, technicians in the various departments, government technical departments or even in the private sector were more or less trained on-the-job. They started with nothing but after three or four years they become good technicians. That takes time, formal education, formal training, now we train them in two years but if there is a need, cannot we do it in 18 months? Without giving too much of the mathematics and the sciences and things like that. And I have asked this question before in international seminar but by my own experience as an engineer, I worked in the public works department for thirteen years but I never used any calculus what more the higher mathematics that I learned in the university. It was just a matter of plus, minus, multiply or divide. So I think crash programmes where necessary should be done and can be done.

CHAIRMAN: I would like to crave the indulgence of the meeting before we adjourn to make some points that occurred to me while I was reading the paper and listening to Mr. Ainuddin. It may be of interest to the delegates to learn something of the procedures which have been adopted in Malaysia for matching the supply of technically qualified people with the development plans. This aspect of it has only been barely touched on in this morning's discussion. We would be interested in how this process has been actually accomplished and with what degree of effectiveness. In particular how the creation of employment opportunities were matched not only by the adequacy of technician training facilities but also of the investment programmes which must necessarily accompany them and that applies both in the public and private sectors of the economy. As we all know there are structural rigidities both in the production of technically trained people and Mr. Parvez has referred to those. But there are rigidities also in the patterns of investment that governments adopt and also the extent of the sector over which the government investment programme extends and how the needs of the government are to be related to those of the private sector and what balance should be maintained between them and what adjustment should be made during the course of years. Now Mr. Koh referred also to Singapore's experience in somewhat this context and I think we might with advantage rely on some further advice from him during the course of our ensuing discussion. I would also like to refer to the experience that the delegation from Fiji adverted to and go back a little into history because of the experience of specific countries in matching not only varying levels of technical achievement but coping with parallel systems of technical education and different standards that these demanded. I think this experience would probably be fairly relevant to this region and countries in it. In the 1960s Mr. R. A. Derrick did a survey of technical education facilities and vocational training facilities in the Pacific Islands and it emerged very clearly then that there was a difference between the systems of technical education in the French territories of the Pacific between them and those of Fiji, Western Samoa, Cook Islands, Papua New Guinea and all the other countries that were members of the South Pacific Commission. I think that if you might give the benefit of your experience since those days as to how these difficulties have been overcome it may be of relevance to our further discussions. Also the funnelling off of technically trained teachers into private industry might be further examined. Many countries within the region have their educational system subverted to a degree that nobody knows the real extent of at the moment for the reason that, as we heard this morning, teachers of technicians have been funnelled off into private industry where they are engaged in training programmes which are highly specialised and only related to the particular industry in which the training is being done. It reduces the mobility of labour and denies qualified people the opportunities for more lucrative avenues of employment and the attainment of higher degrees of skills. I think that where technical education system has been denuded by private industry of the people who are going to supply eventually that it requires a fairly close examination by a meeting of this calibre and some recommendations made in respect of it. I throw these suggestions to you for your further consideration.

SESSION TWO

CHAIRMAN: MR. AINUDDIN BIN ABDUL WAHID

IMPROVING THE STATUS OF TECHNICIANS

by

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Introduction

Technicians are suffering from an identity crisis. Their problem is that they belong nowhere. That this is so, in an era when technology has become a way of life, is all the more ironic. A technician is the most crucial member of the industrial team because he provides the communication channel between the other two members, namely the professional engineer and the craftsman. Whereas the engineer and the skilled worker are placed on a sound footing, have an ethos of their own and are well recognised by society, the technician is not. He is a newcomer—an intruder as it were. The society, the community and the industry do not know what to make of him. At times he is mistaken for an engineer—albeit an associate or an auxiliary one. At other times he is bracketed with tradesmen and skilled operators. He is either a technician engineer or an elevated craftsman. Industry gives him different names—foreman, supervisor, journeyman and a host of other titles, but never a technician, which means, he is never himself, and this brings out the whole question of identity. My thesis is: give the technician an identity and the status will follow.

Image versus Status

The term 'status' connotes many material manifestations including salary structure, fringe benefits, advancement potential and opportunity of participation in administrative and executive policy-making, all tangible and susceptible to measurement and comparison. There is another intangible dimension to status. This is acceptance by society. How does it come about? To my mind, the answer lies in a conceptual rehabilitation of the technicians' entity on a philosophic base. The society needs to be educated about the necessary role of a technician in the process of technological change. Once it is convinced that the technician is an important agent and instrument of change, his recognition shall be spontaneous and ungrudging. The question is one of image-building. At present, since the image is missing prestige and status are lacking.

Integration of General and Technical Education

Let me enlarge somewhat the sphere of my argument. What I have said so far applies not only to the technician *per se* but also to the whole area of technical vocational education below the professional level. To avoid a semantic misunderstanding, I shall call it occupational education. This necessary and legitimate form of education is still languishing on the outskirts of the educational domain. The educational community has not yet fully recognised the claims of occupational education for its rightful place in the educational spectrum. Academicians still mistrust growing tendencies of vocationalism in higher education. Technical and vocational educators have been made to feel like educational outsiders, even in such an enlightened society as that of America. Things are not much different in the developing countries and are in fact, worse. The age-old fallacy of equating higher education only with college and university education persists and the abiding charisma of a B.A. degree holds the imagination of parents and students alike in its grip, as tenaciously as ever. Every community, large or small, clamours for a new college amidst it and considers it a symbol of enlightenment and progress. There is hardly, if ever, a demand for opening a technical or a vocational institute from any quarter of the society. As a matter of fact, conscious social barriers have impeded the integration of occupational education in the mainstream of education. This is an educational tragedy of a colossal magnitude and it poses a challenge to the democratic ideals of the educational aristocracy.

The Case for an Integral Curriculum and Certification

Curricular offerings for technician education have not been visualised as an integral whole. As if by design, exact demarcation of the technician territory within a large industrial continuum between the work of an industrial worker and that of a professional engineer or technologist has been left vague. What has compounded this issue is the fact that a person can take several different routes to the goal of becoming a technician. He can be job-upgraded or alternatively he can pursue one of the many full-time institutional courses leading to a Technical Diploma. There is no systematic mechanism to assess the relative merit and performance potential of persons arriving in industry from different directions and aspiring to fill technician-level vacancies. Further, since the work of a technician is loosely spread over a wide range of activities of varying vigour at different levels, the new recruits mostly fit in somewhere and later grow in the job. This leaves a rather hazy impression about the entry requirements for a technician's job. Thus, the opportunity for the development of a vigorous academic discipline based on stringent pre-employment requirements is largely denied. This dilemma can be resolved only by introducing a system of certification by a National or State Council of Awards, which can lay down criteria of assessment for a catalogued variety of technician jobs. Since persons and institutions are habitually attuned to the concept of certified knowledge, this procedure will pave the way for standardising the academic discipline for a technician career. Persons measuring up to this discipline should find no difficulty in holding their own in surmounting the whims and vagaries of the personnel recruitment departments of employing agencies and in finding jobs worthy of their calibre, attended by appropriate salary structure and status.

Need for Co-operation with Industry

It is a cruel paradox that the very customers for whom we, the educators, have been endeavouring to custom-build our products in terms of adequately-prepared technicians, have at best been lukewarm, if not downright apathetic and antagonistic to the whole exercise. The initiative in the direction of the education and training of technicians has invariably come from educational institutions. Industry has seldom indicated its needs, either quantitative or qualitative. The reverse should have been true. This has given rise to a communication gap between the two sectors of society. What education produces on its own does not meet the approval of industry and industry lacks the motivation to spell out its precise needs and specifications. The sufferer in the bargain is the technician himself. Not infrequently, industry has voiced its dissatisfaction about the qualitative product of polytechnics and technical institutions, and as a result the adequacy and relevance of technician education have been seriously questioned in some circles. My own impression is that industry, by and large, is prone to equating technicians with skilled workers. It may well be that our public relations effort has been lagging. We should have learnt to be more imaginative in selling our product. The fact remains that both industry and educational enterprise have been functioning in isolation. The ideal situation would demand involvement and association of industry in all stages of planning, developing, administering, training and placement services of technician programmes. There should be restored a two-way traffic between institutions and industry thereby facilitating a free inter-flow of students, teachers, industrial personnel and above all of ideas to achieve a harmonious and well-co-ordinated plan of action. The realisation of this objective is by no means an easy task. This should however not deter us from trying earnestly, diligently and persistently. In quest of status, this is the most formidable obstacle. The salvation of the technician lies in his total acceptance by industry, without any reservations or inhibitions.

Broad-based Education

In order to dispel the mistaken notion of a narrow job-oriented training, inevitably linked with it, technician education should be made more broad-based without sacrificing the all-important technical content. A good grounding in science and mathematics would enhance the horizontal and vertical mobility of the technician. Inclusion of courses in languages, sociology, economics and psychology in the framework of technician education curricula would prepare the student for a better understanding of his environment. The product of such curricula should have no problems of adjustment in society and in time they can hope to assume roles of leadership in their chosen fields. In this context, I can do no better than quote from the recommendations adopted by the General Conference of Unesco in 1962:

> Technical and vocational education should be an integral part of an overall system of education and as such consideration should be given to its cultural content. It should do more than train an individual for a given occupation by providing the person concerned with the necessary skills and theoretical knowledge; it should also, in conjunction with general education, provide for the development of personality and character and foster the capacity for understanding, judgement, expression and adaptation to varying environments. To this end, the cultural content of technical and vocational education should be set at such a level that the inevitable specialisation in technical and vocational education does not stifle broader interests.

Foundation Courses in Elementary and Secondary Schools

One reason why occupational education has not come into its own is that it has a negligible, if any, foundation base at the pre-secondary and secondary levels of education. Almost all education in the elementary and high school is based on liberal arts and pure sciences and is directed towards continued education in the same vein at the college and university level. Very few vocational options are available in schools and, in any case, the majority of students do not get the opportunity of exposure to them. Coupled with it is the fact that vocational guidance services at the school level are either non-existent or fragmentary and ineffective. No wonder that the student community grows up and matures in a rarified atmosphere of humanities blithely unconscious of the world of work. On terminating their secondary school, and finding extremely limited places in higher humanistic education open to them, they are all of a sudden confronted with the necessity of making a vocational choice. Blindfolded quite a few of them are herded into the technical and vocational institutions, where for lack of adequate preparation and motivation, attrition rate mounts and the quality suffers. This is an unenviable spectacle, where we have a mass of uninspired and uninspiring individuals on our hands being subjected to an unfamiliar regimen of physical and manual work in workshops and laboratories, and being led inexorably to a world of work of which most of them carry a very foggy notion. This obviously is no way in which individual motivation and career confidence can be sustained. A person who has had no mental preparation for his future career can make but a poor functionary in the field of his subsequent choice. The point that I wish to stress is that individual pride and confidence in one's job are a prerequisite for a successful and productive career in a fiercely competitive industrial world. These attributes cannot be developed overnight. They have to grow, as a person grows. It is, therefore, imperative that the earlier motivations in the formative years of a child are given adequate channelisation through his early involvement in vocational activities as embodied in industrial arts subjects. We in Pakistan have already started responding to these realities. The new blue-print of our educational system incorporates the concepts of agro-technical education from classes VI onwards, on a compulsory basis. About 8-10 class periods per week in schools are now devoted exclusively to these activities. We are confident that in this way we are fostering an in-built facility in our student community to adapt readily to the demands of a technological age. We hope that their transition into the job market would be quite smooth as, in addition to their specialised skills, they would be possessing a set of values very much in consonance with career growth.

Continuing Education

Advancement and promotion prospects constitute one of the major criteria for a career choice. Technician education, on the other hand, embodies concepts of terminality with the result that a technician career holds no promise of an automatic rise in course of time except for the gifted few who can transcend by force of personality or performance the limits imposed by educational finality and even then they cannot hope to reach the top. This, in my opinion, is a severe limiting factor in the growth and mass acceptance of technician education. People do not like dead-ends and rightly so. In a free democratic society, educational regimentation and job stagnancy would not sell. Some educational outlets must be provided for the benefit of those persons who are denied promotion for want of higher academic or training qualifications. This has particular relevance for the technician who can look for elevation only through the educational ladder. In support of my argument I again refer to one of the resolutions of Unesco General Conference; passed in its 12th session and I quote:

> Technical and Vocational Education should be so organised that every person can continue his education, until his potentialities have been developed to the full. Transfers from one field of technical and vocational education to others should be possible and access to all levels of both technical and vocational education and general education should be open to any capable person. Appropriate measures for making such access possible should be taken.

The implications are clear that for ensuring professional advancement and respectability for its product, technician education would have to be designed on a continuing and life-long basis. Several pioneering programmes have been geared into action in this direction in the United Kingdom, United States of America and some other countries, including Pakistan. In Britain, some diploma-awarding institutions have been upgraded to the level of Colleges of Technology with a degree-conferring status. Loughborough College of Technology is an example. By collaboration between schools of education and schools of engineering, some American Universities have introduced B. Tech. degree courses for the graduates of technical institutes. A case in point is Oklahoma State University. In Pakistan, some of the existing Polytechnic Institutes have been converted into Colleges of Technology to provide, in addition to their regular diploma programmes, opportunities of further education to their diplomates. The programme envisages four years of sandwich instruction alternating between supervised industrial training and institutional study on an equal basis and finally leads to a B. Tech. Honours degree. An elaboration is contained in the Annex. It is hoped that the term 'technologist', would come into vogue, to define and qualify a person holding a B. Tech. Honours degree as distinct from the engineer, who would take the conventional route. There should be no clash of interest between the new technologist and the old engineer, as the former is not intended to supplant the latter, rather to supplement him. Whereas the enginer would be the creator, the visualiser and the designer, the technologist would be the producer, the implementer and the actual doer. The idea is that with the rapid pace of technological development, the engineer will enter the creative domain and his day-to-day work, as we know it, is likely to be taken over by the technologist and the senior technician. We have to prepare not only for this fast-approaching contingency but in the bargain we also have to boost the educational level of our present day technician with mutual benefits accruing to both the industry and the industrial technician. The conventional route of higher technological education is already bursting at its seams with force of numbers and for those who have missed it there is no alternative except to explore another route. The emerging programmes of higher education leading to higher diplomas and degrees in technology are directed towards this goal, and this incidentally is a happy augury for the enterprising technician, who is determined to make his mark in life.

Professional Status

Next we come to the question of a professional status for technicians. Are technicians professionals, semi-professionals or sub-professionals? The consensus of opinions of educational and professional bodies has so far favoured the semi-professional status for technicians. To me it appears that this question needs to be probed further, not by reference alone to the functionary but also to the function itself. Can the job function of a technician be classified as a profession? If the answer is in the affirmative, the question of determining the exact station of the technician in the professional hierarchy is largely academic. Let us apply the accepted norms of a profession to the work of a technician and see how it measures, both in theory and practice.

(i) Technician practice has a distinctive character and a meaning of its own. The emphasis is, however, on the application of a speciality.

(ii) Technician practice has a body of knowledge and skills, not necessarily esoteric, but exclusive to its practitioners.

(iii) There is no requirement of registration for a technician at present. It does not follow that there should not be one.

(iv) No legal protections are normally extended to technician practice with the result that persons with undetermined and undefined backgrounds may also enter the practice at varying levels in different specialities. There is a need for adopting preventive measures to discourage quackery.

(v) Exclusive professional bodies of technicians have as yet not emerged on the scene. There are instances, however, of some specialised technicians having been affiliated with professional bodies at a subordinate or less-than-professional level.

(vi) No code of ethics has been evolved for technician practice. The need is of course, there.

(vii) In the capacity of a distinct section of society, technicians, on an organised basis, have not demonstrated any response to the growing socio-economic, environmental and civic problems of society. Technicians have no conscious association or involvement with public service. There is, however, a big service potential to the community, lying unrealised, for technicians, if they can organise themselves into an association, a guild or an institution. This can also serve them to solve their own problems by functioning as a clearing house of ideas, of certification, of co-ordination with professional bodies and above all of image projection before a society which, to a great extent, is oblivious of their existence.

The implications of the preceding discussion are clear; whereas technician practice has the meaning and the potential to be recognised as a profession, at present it is in complete chaos and disarray. An acute awareness of the disadvantages resulting from the absence of organisation in the technicians' ranks is essential before strategies for corrective action can be evolved.

Research Orientation

Occupational education is research-starved. It has developed largely as a result of isolated industrial needs of the moment. There is no conceptual and sustained movement behind it. The hesitancy of its birth is reflected in its growth. I believe that the missing dimension lies in the absence of an adequate research base for all facets of technician education. Higher education has not owned this form of education, although essentially it is post-secondary and college-level, which means that universities and other institutions of higher learning have ignored it in their research framework. Technician educators themselves have defaulted in not initiating research activities for supporting their crusade of credibility. Against entrenched and fortified educational systems and philosophies missionary zeal alone cannot succeed unless it is supported by an arsenal of rationality and irrefutable statistical evidence. This can be provided only by relevant project-oriented and applied research. No worthwhile research services have been provided in polytechnics and other technical institutions. Research has been treated like a forbidden ground. This is why, the development and growth of technician education and its acceptance both by industry and society have been seriously impaired. I invite your attention to a sample of some possible research topics and leave it to your imagination to assess their significance for the topic under discussion today:

— Development of conceptual resources for integrating occupational education in the mainstream of education.

— Matching occupational spectrum with educational spectrum

— Programme planning.

— Manpower projection.

— Career development.

— Curriculum development.

— Evaluation techniques.

— Meaningful involvement of industry in technician education.

— Higher technological education for technicians.

The Technician and the Colombo Plan Bureau

An important medium for generation, clarification and propagation of new ideas and concepts is provided by national, regional and international seminars, study conferences, workshops and colloquia. Technician education, being a comparatively recent claimant for recognition, stands to profit a great deal from this medium. It is a matter of record that Colombo Plan Bureau has made extensive use of this medium for boosting the faltering image of technicians in the countries of the region. Up to date, fourteen national seminars, six colloquia (including the one in progress now) and one country workshop dealing with technical and vocational education and intra-regional technician training have been held under the sponsorship of Colombo Plan Bureau in different countries. Reports of these gatherings have duly been published and circulated. The growing concern of Colombo Plan Bureau for the improvement of technician education has found expression in the establishment of Colombo

Plan Staff College for Technician Education in Singapore which has imparted an institutional character to the whole effort. I am confident that educational planners and industrial leaders in all the member countries of the region have learnt from the work done so far under the aegis of the Colombo Plan. We who are present here today, and our other colleagues back home owe a debt of gratitude to the Colombo Plan for conceiving and fostering an ever-growing movement of regional co-operation in the fields of training and student awards, provision of experts, intra-regional technician training programme, provision of equipment and machinery and a host of other allied activities. The technician, as a technological and philosophical entity, has been one of the chief beneficiaries of these activities and his recognition and rehabilitation have in turn helped the development effort in the countries of the region. This issue that we are considering today concerning the improvement of the technician status is one which has been receiving priority attention in several direct and indirect ways from the Colombo Plan since its inception almost a quarter of a century ago. We can help the technician further, by entering into a working and willing partnership with the Colombo Plan Bureau in all its activities.

I have one little suggestion to make to the Bureau. I would imagine that Intra-Regional Technical *Education* may have greater prestige value and selling potential than Intra-Regional Technician *Training*. This would also be in keeping with our thinking today.

Concluding Remarks and Summary

In conclusion, I think it would be useful to present a summary of the major points made in this paper:

(*a*) Technicians have to achieve a clear functional identity before they can find their feet.

(*b*) Image-building should precede status-building.

(*c*) Technician education must be integrated in the overall system of general education.

(*d*) Technician curriculum should reflect an integral unity under an umbrella of certification and standardisation.

(*e*) Association with industry is a *sine quo non* for any improvement in technician education and in its attendant status.

(*f*) Narrow specialisation may be avoided to provide technicians with greater job mobility and adaptability.

(*g*) Foundation courses in Industrial Arts should form a prerequisite for technician education.

(*h*) Doors of higher technological education must be opened to aspiring technicians.

(*i*) A professional character must be developed by the technicians either on their own or in collaboration with existing professional bodies.

(*j*) A research base is essential for the growth of technician education.

(*k*) Regional co-operation has prospered under the aegis of the Colombo Plan and it has a great future in the field of intra-regional technician education.

All these points have a direct or an indirect bearing on the question of status of technicians. Let us view these points in their proper perspective and corelate them to find a solution to our problem.

Questions for Discussion

(i) How can occupational education capture the imagination of society at large?

(ii) How do we prepare a distinct and integral curricular design for technician courses?

(iii) What alternatives may possibly be provided for higher education to the technicians?

(iv) What priorities should we assign to various research topics listed in this Paper and which agencies should carry out the work?

(v) How do we ensure industry's involvement in the educational enterprise?

AN OUTLINE OF HIGHER EDUCATION FOR TECHNICIANS IN PAKISTAN

I. Excerpt from the Education Policy 1972-80:

Polytechnics will be converted into Technical Colleges. Their present programmes of certificate and diploma courses will, however, continue. After completing a 3-year diploma course, students will be encouraged to undergo two years of industrial training/experience for which opportunities will be provided.

II. Excerpt from a policy directive from the Government of Pakistan:

2. As envisaged in the new Education Policy, the following programme was adopted. There will be two degree courses for diploma holders: (i) B. Tech. (Pass) and (ii) B. Tech. (Honours).

3. Admission to the B. Tech. (Pass) course shall be subject to the candidates fulfilling the following minimum requirements:

- (i) **Three years diploma from a polytechnic institute in first division;**
- (ii) Two years industrial training/experience. Candidates without industrial experience shall be required to undergo one year's supervised/guided practical training in industry to be arranged by the institution concerned;
- (iii) Performance in the admission test.

4. B. Tech. (Pass) course will consist of a year's programme of studies at the institution. The degree of B. Tech. (Pass) shall be treated at par with Bachelor's degree in science.

5. Candidates having successfully completed B. Tech. (Pass) degree course shall be eligible for admission to a two years B. Tech. (Honours) course. The first year of this course will comprise supervised/guided industrial training during which the students shall be assigned specific projects relevant to their fields of study. The second year will consist of intensive study at the institution. B. Tech. (Honours) degree shall be treated at par with B.Sc. (Engineering/B.E. degree).

III. Proposed fields of technology for B. Tech. Pass and Honours Degree Programmes

- (i) Chemical Technology;
- (ii) Mechanical Production Technology;
- (iii) Refrigeration and Air-conditioning Technology;
- (iv) Auto and Diesel Technology;
- (v) Electronics and Communication Technology;
- (vi) Public Health Engineering Technology;
- (vii) Civil Construction Technology.

IMPROVING THE STATUS OF TECHNICIANS

by

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What is a Technician?

I think it is important at the beginning of this Paper to have it understood what I mean by the word "technician" as it applies to a category of person in the field of science or engineering. It is generally understood that the technician in industry comes somewhere between the engineer and the craftsman. Each of these categories is equally important and all three are mutually supporting. In the normal economy it is expected that there would be more technicians than engineers and more craftsmen than technicians.

The engineer is by education a designer. As one professor said to us in the University "You were not sent here to learn to repair someone else's machine. You were sent to learn the fundamentals from which you might design your own machine".

The skilled craftsman can construct and repair within the sphere of his trade.

The technician can put the engineer's design into effect, operate and maintain the finished product, possibly through instructions to the craftsmen. He can diagnose trouble and instruct the craftsman in the rapair. He knows not only how an engine works but also why it is designed that way.

I include certain types of middle management in this category, for example the garage superintendent who instructs the machanics and the construction superintendent who supervises several craftsmen.

Although, of course, not all technicians are in the engineering field, I feel that the same general engineering categories might be used to classify them, for example:

Mechanical	—	machine-shop superintendent
Chemical	—	laboratory technician
Electrical	—	power house operator
Electronic	—	telecommunications technicians
Civil	—	surveyor

I have given only one example under each category but, of course, the list of examples under each could be quite long.

Then again, within these categories we do find engineers doing a technician's job and a technician doing an engineer's job according to my previous definition of the terms. There is no apparent fine line of distinction.

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Lure of the Degree

What then is the real difference between an engineer and a technician? To the public it is a matter of degree—a University degree. In the East, in colonial time a University degree was almost sure to find a man a place in the hierachy of civil servants. Although the number of degree holders has long since far exceeded the, number of government jobs available the social status of the degree has remained. An engineer has a value approximately that of a medical doctor in the marriage market according to advertisements I have read.

In order to keep up with the tremendous strides that have been made in scientific advancement in the past thirty years the engineering university has to concentrate on the teaching of advanced mathematics and physics and has little time for practical problems. The engineering degree, therefore, indicates a capacity to absorb and reproduce a knowledge of mathematics and physics in their most sophisticated forms. It is not a measure of a man's ability to perform in the world of industry.

More than thirty years ago Professor Stephen Leacock, addressing a gathering of engineering graduates of McGill University said "Just because a man holds a Bachelor of Science degree does not mean that he knows anything about science. It only means that he knows nothing about anything else".

Yet the status given by the degree is such that a man who is mechanically minded (and I use "mechanical" in its widest sense), but who feels unable to cope with the higher mathematics, will look for a degree in liberal arts or some profession other than engineering and, possibly, a good technician is lost to the world of industry.

It does not seem to matter that on graduation from a technical college he might find an interesting technician's job waiting for him while many engineers are unemployed. To him a technician has the status of a senior craftsman.

It is this prejudice that it is necessary to overcome by improving the status of the technician in the eyes of the public, the employer and the individual technician himself.

Technicians' Associations

As a first step to obtain public recognition, technicians' associations with their own government charters might be formed. They would set their own standards of membership to protect the public just as the engineers do in their institutions, the lawyers in their Law Societies and the doctors in their Medical Associations. Associations of technicians exist under one or another name in Britain and Canada and probably in other countries. The associations should give maximum publicity to their meetings and publish their own journals.

Recruitment

Employers who advertise to recruit technicians should be encouraged to require qualifications for membership in a recognised technician association or equivalent.

Pay

The employers should pay a technician a wage commensurate with his technical education, experience and ability. But the rate of pay is not always the most important factor in recognition of the technician. Social status is often more important than pay. It has been my experience that a qualified driver in the East will take a job as a clerk at less pay than he would obtain as a driver. Often in the West a foreman makes less money than the craftsmen he supervises but then he is part of management and has a permanent position.

Working Conditions

Which brings me to the improvement of status of the technician by the provision of suitable working conditions to emphasize his permanent place in the firm as an individual. He should have a work place of his own whether it is an office, a cubicle, a desk or a bench. There should be some place where he could display his diploma or certificate of association membership. If a superintendent he should have his own office with his name on the door. The technician's name should be in the firm's directory or telephone book. If it is necessary that he should represent the firm or if he is self-employed he should have his own calling card giving his qualification. If his job requires transport for supervision purposes he should have his own allotted vehicle.

Dress

He should be encouraged to dress in a manner distinct from the craftsmen even if it is only wearing a lab coat in the laboratory or garage. In England you used to be able to identify the foreman on a job by his bowler hat and collar and tie.

Pride of Performance

I have spoken of improving the status of the technician by an association, by commensurate pay, by treatment as an important individual in his working conditions and by dress but the most important factor in such improvement is that the individual himself must be convinced of the necessary part he plays in industry and of his ability to play his part well.

I have often told the story of the technician who came to our house to repair the television set. He was explaining to me the reason for the trouble when my wife remarked "You know you are speaking to an electrical engineer". He replied "An electrical engineer cannot do the job I am doing".

This pride of performance accompanied by the ability to perform well should assure the technician of his place in industry. It is up to him, his association and his employer to ensure that his proper status is given recognition by society at large.

Discussion on Mr. Parvez's and Brigadier-General Connelly's Papers

CONNELLY: I would just like to comment on this matter of the degree of bachelor of technology. We toyed with the idea of a bachelor's degree in Canada, bachelor of practical engineering, bachelor of constructional engineering and so on. You must try to think whether it is better to have a first-class diploma or a second class degree. I think that the degree seems to be much more important in the East but one thing I have in mind, as I have pointed out, is that the engineer is a designer. This is how I distinguish him from the technician. And I have actually sat on a Board of Enquiry of the Association of Professional Engineers in Ontario where an engineer was suspended because of a mistake in design whereby ten men were killed. This I think is a very important point that an engineer as a designer must stand behind his design and I wonder if this can be carried out on to the bachelor of technology degree. When we talk about the bachelor of practical engineering, we do not look upon him as a designer—that is the first point I want to make. The second point was the matter of a man coming out of the technical college being accepted into industry. There is always this reluctance on the part of the employer, he wants a man with experience. This has been raised by Mr. Parvez but we found that when you take the man into the firm or on a project he does have to learn the way the firm works. You might say he has a term of apprenticeship if you like regardless of this qualification at the college, he works under some-body else for a while and then there was, but not always, sometimes a feeling that the man under whom he works does not want to see himself superseded. And you will find that the person who has been through the college very often will go ahead much more quickly than the man who has learnt and come up through experience without having learnt why. One of the reasons I have suggested these associations with their own terms of reference, terms of reference as far as admission is concerned, is that of course many technicians do come up through industry rather than through a college and therefore you need some basis of examination if you like, some way of qualifying people but this of course is always overcome in the engineering associations and particularly in Britain. Nowadays as they say an engineering degree is so sophisticated, the man goes out to the firm to learn his engineering, he has just learned the basis which he can perform but then he does actually get his experience after he leaves the college or he leaves the university.

CABOT: On the point that Brigadier Connelly has brought up and also on the basis of Mr. Parvez's Paper, I would like to relate the situation with regard to technician degrees we are calling them that at the moment in Australia. We do have so-called technician degrees in various forms—B.Sc. Tech. We even had a Master's degree in building construction—I do not know if there is as yet a Bachelor's degree—we have got a Master's degree entry to which is by qualification which may not be even of a university standard. These are highly practically oriented degrees but I see there is a danger in them whilst they are essentially practical degrees. In fact a person going into such degree expects when he comes out to be treated as the technologist and to be paid accordingly and in fact that is the situation in Australia now whether in the countries represented here such degrees would carry a similar connotation it is not for me to say or even to surmise but I foreshadow that it would possibly happen. I feel that rather than a university degree, bachelor or master or what have you, we should be looking for some higher technician qualification, a higher diploma or something like that. Once we see a person has a degree, to my mind anyway, he is considered to be at the ultimate level of qualifications and consequently he is an engineer or a technologist or what have you. I think we should look for a higher diploma or some name like this to really pinpoint the idea behind his qualification.

SEN: I like to ask a question from Mr. Parvez. We have our Institute of Diploma Engineers for the technicians but they could not build their image. This is because during their three years course of training at the polytechnic institute almost one and a half years is the vacation, and the curriculum as designed is not appropriate. We teach everything but nothing. So when they go for the industry they cannot work well because they are the middle-men, they have to communicate with engineers and the craftsmen. They are failures there. If we want to enhance more courses for the horizontal and vertical mobility then it means we are to sacrifice more practical contents of the subject than what we are giving at present. The practical contents of the subject is very important, I think. So do you consider whether that course should be increased to four years or should we lower the vacation?

PARVEZ: I think you have made very valid observations. I myself would like to curtail the vacation period and to observe the hours that industry observes so that the technicians have an early exposure to their subsequent work but there are many factors in this, for instance, political factor, student factor, student association. One reason why we have started this B. Tech. Course in Pakistan was because of student pressure. That is one reason. There were other reasons also and they wanted to call their polytechnics as colleges and so the institutes where we have started these courses we now call them colleges of technology so that in terms of student status, if there is such a thing, they are now at the same level as other colleges. They have the same type of unions, same type of bargaining power. Although I would like to have kept the institutional and the polytechnic entity but somehow we first started with technical colleges. They say technical colleges still does not connot enough status so they went to college of technology. Regarding this introduction of general education courses, I think if you read my paper again I have said without sacrificing the all important technical content within the same framework. I mean within three years of instruction you can so arrange your curricula, that you can give some more science, more mathematics and also some sociology, economics, psychology and so on. I have talked of re-designing the curricula in such a way that a person does not get a very watertight sort of discipline. If he has a sound general education then it is easier to re-train him, to readjust him according to technological changes and all that and he can seek a job in a variety of setting. But if you make him like a skilled worker rather than occupational oriented his curricula then may have an hampering effect on his later career growth and on his later adjustment and changes.

SRINIVASAN: In the total employment context of the country I just want to know whether when this new course was introduced, B. Tech. Course, was there any organised reaction on the side of engineering students or engineers as such against this step? And, what is general ratio between technicians and graduates in Pakistan?

PARVEZ: Regarding your first point, there was all along a big resistance from the Engineering Colleges and Engineering Universities. You know our first line of attack was to get admission places for our technicians in the Engineering Colleges themselves in their existing courses and they said that although they had better practical background, their theoretical background was much less in terms of mathematics and science and so they did not admit it but we persisted, rather the boys persisted. Ultimately the Engineering University, Lahore, for instance which admits I think six to seven hundred students every year allowed 20 seats for our polytechnic diploma holders but they did not give them any exemptions. They started right from the first year like the higher secondary students, intermediate students. So we were not happy, the students were not happy and then we had to branch out in this line. Engineering University have affiliated this course with them. They have not come out with their cards on the table but they are quite helpful, we prepared actually the courses, they revised it and reviewed it and finally accepted it, then associated and affiliated. I mean these colleges of technology are now affiliated with the university of engineering and technology, Lahore, which is the only University of Engineering in Pakistan now. Stretching this argument, Mr. John Cabot said there may be some clash of interest between this breed and the professional engineer but if you look far ahead, for instance, in America, they are thinking of making M.S. the first professional degree for an engineer because the quantum of knowledge is doubling every 20/30 years now. You see what is important is not change but the rate of change, so if M.S. becomes the first professional degree, may be then there is enough room for this new breed. But even without that, in certain specialised fields, such as air conditioning, electronics and automobile engineering the industry needs them. We have, however, limited the number, for instance in Punjab against 2,000 technician enrolment out of which about 1,800 pass out every year. We have only provided 80 places as a pilot venture for the B. Tech. courses and that is a very minuscule quantity to start with. May be once they are a known quantity we have to increase the seats. About the ratio, I think it varies. In government departments we always have 1:3, 1:4, 1:5. In chemical industry, the private industry the ratio may be 1:1. In some other industry for instance I am talking of big manufacturing concerns the ratio is 1:0 sometimes. They do not have any technicians at all. They are not familiar with them.

KOH: We are talking of the identity crisis of the technician and his inability to get recognition. Now in the normal order of things, there is a hierachy, now we have the engineer, we have the technician, we have the craftsmen and we have the operative at the bottom forming a pyramid. The shape of this pyramid whether it is flat or sharply upwards depends on the state of technology. Now the identity crisis arises only when we have produced a technician who is neither here nor there, he is neither a designer nor an executor and if we as technician trainers produce our technicians to specifications to perform the job they are supposed to do the identity crisis should not arise. Regarding the question of status it seems to me that we cannot legislate or force recognition of the status of a technician. Status must be earned. If I was a production manager and I will pay a technician what he is worth, I will give him the status he deserves in my organisation because he is worth that much to me, he performs that much for me, and not because some dean of some engineering college tells me that he must be paid that much. So we are going to look at it from his productivity within a production situation. I have been at several conferences of educationists, university educationists and now I am with a group of technician educationists. There is a danger of the educationists sitting in his ivory tower and saying that my system is perfect, the world must change to fit me and my system. The educationists must come out of his ivory tower, go and look at what is wanted. There was mention that in most cases the technician is equated to a skilled craftsman. If that is what industry wants then let us produce highly skilled craftsmen and give him—so that he gets his status in the society. There is no point in producing a technician to your specification which does not meet the requirements of industry and which industry refuses to accept. So this is the thesis, a man has to earn his status. I remember also he has to earn his living. The Production Manager is not obliged to pay a person just because he comes waving a piece of paper. He has got to earn. Now what is that paper worth, what can you do for me in my organisation. You want 2,000 dollars, are you worth 2,000 dollars to me but if you are, I will pay you that 2,000 dollars not because you have a beautiful piece of paper with archaic language and some beautiful crest and some beautiful letters. That is not the way life goes on in this world. There was mention also of the lack of psychological preparation and earlier I mentioned that our culture gives status to the person who never dirties his hands, and I did suggest that there was this need for the preparation of people for technician education. I heard of Pakistan starting it in the sixth year in the schools and I think that is the right direction to go. We have got to bring the cycle round from a society—all of us come from societies in which the way of life is related to the hands and earth. You start working from there. Now through a series of influences we have reached a stage where the status is that everybody aspires to wear a nice clean shirt and wave a nice clean piece of paper. We have got to bring that cycle back to the dignity of work. But if it is necessary, let us dig in the soil, let us crawl under the machines, let us get ourselves dirtied all over and come up from there. There was talk of access to higher education and there was a quotation from some Unesco report about access to higher education. Now I like to make a distinction between access to more knowledge as distinct from access to higher degrees. However, we can increase our knowledge but I would like the fields of knowledge to be open to me, in other words I am free to learn more about alot of things but that is not the same as saying I must be accorded a Master's degree because I have put in two years of extra learning and that I must be given a Ph.D. because I have put in another two years of learning. We are all learning. Sometimes we pursue down a narrow specialisation, sometimes we try to broaden our base of education. We end up as administrators, we are engineers, we are administrators or perhaps we are education administrators we should be reading about educational psychology but that does not mean that I must be sent up a university to do a degree in educational psychology, or educational planning. So the access to this knowledge must be open to me but I do not think it is necessary that this must necessarily be accompanied by an access to a degree. So the emphasis on higher degrees, higher universities, would result in us having a lot of engineers but very few craftsmen. It is like having an army of generals, no privates to fire the rifles, so that army is ineffective. So I submit that the access to higher education is not necessarily access to higher degree. We have a credibility gap here, now here Mr. Sen says that he has got his three year diploma and it is not recognised by industry, now what are you going to do, make it four years and give him a degree. Does that make him more credible? I do not think that is the answer. Now, taking a moral from sea-faring, if you run into trouble with heavy wind, what do you do, you just jettison all your unnecessary stuff, you trim your sails and sail through. So may be the solution might lie in taking a close look at our curriculum, trim it down, throw out all the frills and instead of making it four years, make it two years and probably the technician will be recognised then. That may be a frivolous approach to it, I mean, may be that is the situation. So we have this business of status. Now we want a status to a diploma. What is a diploma? A diploma is a piece of paper. It does not prove whether I am good at my job, I got a degree in economics, I got a degree in education, it does not prove a thing, whether I am a good economist or whether I am a good educationist. The taste of the fruit is in the eating, now to what extent am I useful to the organisation who is paying me and that I think is the test of it. So if our technicians are not getting the recognition is it because we as technician educators have not given them the right sort of training and I put that forth for consideration.

PALA: I am impressed by the excellent papers which have been presented this morning by Mr. Parvez and Brigadier Connelly and I would like to make a short remark. We are talking about improving the status of the technicians and when I glanced through the list of the participants, I see that there are many people such as Directors, Vice Chancellors, Deputy Directors, top people, and educationists. It would be good if in future meetings of this kind some representatives of industry and of the technicians themselves were also present. There may be some senior technicians who could well defend their case and we all could learn very much from them. Reference was made to including social science components and culture into the curricula of technicians. I think it is a good point and Unesco is promoting this. We discussed this problem also during our meeting recently in Manila and there are people who are very much for it here—other group of people say this is not so much the task for the polytechnic or training institution and personally I was a little disappointed as they were saying that it was more a task of mass communication media. I am very glad that this point came up also this morning. I was thinking and it is a personal remark of the delegate from Singapore, which I am in favour of personally, that when you make the technician training too long then the technician may lose his status, industry may think why did you stay so long at the education institution, why did you not come earlier to us. So if you make the technician training too long, you come too close to university level may be these are my remarks.

MANANDHAR: In Nepal we have some programmes for upgrading the status of the technicians in various fields. In the secondary schools of the country some vocational education is offered in the fields of agriculture, home science and industrial education. In the same way some courses have been developed in technical fields in higher education. We offer some technical training to those who work in the field. The problem is that the technical programmes developed in the secondary schools and in the colleges have some greater social value. So most of the technicians in our country have developed some kind of degree consciousness. Now we have come to the conclusion that the courses offered in colleges and in schools were not relevant, the products from the colleges and the high schools have not been that useful to solve the technical manpower needs of the country. So the problem is how to develop in the minds of the young technicians the urge of obtaining technician education offered by the Government in formal ways. So I like to ask Mr. Parvez, what kind of programme do you have in your country for the technicians so that they get some security and later at the same time they fulfil the needs of your country in terms of manpower?

PARVEZ: In Pakistan we do not have many of these sandwich or inservice programmes, as far as technician education and training is concerned. We have some programmes of apprenticeship for the skilled workers. There is an Apprenticeship Act and under its provision, we are training skilled workers in industry but I must clarify that these programmes leave much to be desired. Since these are being administered under a compulsive act they are mostly window dressing type of thing. In polytechnics we offer three years full-time technician training programmes. We also offer some sandwich programmes for the industry mostly at the skilled worker level and for the in-service people in polytechnics. There are two points, one is that the industry unfortunately in my country is concentrated or largely comprises of small industries, a small entrepreneur having 10 or 20 people and 80 percent of the labour force is employed in this way. So this is one reason why the acceptance of the technician by industry is in jeopardy. The industry does not know its mind. It cannot identify its needs. There are some very enlightened industry, for instance, in Lahore we have Paper Manufacturing Packages Ltd., employing about 250 of our technicians I mean diploma holders, and their Managing Director in one of his Papers said that engineers come and go but these technicians are the backbone of our industry. He highlighted the point that industry is impatient, it expects finished goods from institutes which is not possible. So they take our technicians, train them for 18 months, break them in the job and once they do that the technicians prove of immense value to them, some of our technicians are holding high managerial posts in that very firm. So after a lot of probing with industry I came to the conclusion that the type of technicians that we are producing may be is an engineering technician and what the industry needs either an elevated skilled worker or industrial technician. So recently we reviewed our curricula and we have redesigned them in such a way that the emphasis now is more on applied skills because the industry thinks that the technician should have a fair mastery of those skills which the average industrial worker possesses.

SKELTON: To enlarge a little on the deformalised type of courses mentioned in connection with Sri Lanka, you mentioned that this did not involve so much in the way of the normal equipment that we have in technical colleges but centred more around an industry you mentioned, the bicycle industry. Would this meet with the same problems that all courses meet that industry wants the technician but really is not prepared to do a good job on the training. I did not quite understand it. Could you enlarge on it please?

PARVEZ: You are talking of the context of Sri Lanka and the agro-technical education in schools.

SKELTON: Yes.

CHAIRMAN: I do not know whether we should not ask the delegate from Sri Lanka.

PARVEZ: That could be much better.

PASKARALINGAM: I must thank Mr. Parvez for complimenting Sri Lanka on the occupational studies programme that we have started in Sri Lanka. I think in order to put it in its proper perspective I must give a little background. For a number of years our country has been plagued with the problem of unemployment of graduates, liberal arts graduates, thousands of them have been passing out of the universities but were not getting employment even as teachers, even in any other form, even as clerks. So we were virtually forced into re-thinking the entire curriculum from primary grades upto the university. Though there have been references here about integrating technical education with general education and a comprehensive pattern of education our experts too thought on those lines and after several discussions it was agreed that it will be difficult to provide technical education or integrate technical education with general education for the entire country. After all technical education with equipment, workshop, etc., is very costly. The cost factor would have prevented us in implementing such a programme. It was identified that the real problem was the attitude of the students whose aspirations were for white-collar jobs. So the question was how best to change it, and encourage them to work more with their hands, they should be told of the opportunities. So we thought that compulsorily 20 percent of the entire school time should be devoted to occupational studies. When I say occupational studies it was not the vocational programme as such, at best it was a prevocational programme. In order to cut down on the expenditure, as it was compulsory and as we had to provide it for the entire country, we devised a system based on occupations which were prevalent in the different regions of the country. For example, in the coastal area, fisheries, in the coconut growing areas it is something to do with the coconut industry, in the urban area something to do with bicycle repairs, motor car repairs, etc. It is this pattern of occupational studies which was started in the curricalum. Two periods out of ten periods, in other words 20 percent of the time is devoted to occupational studies, the teachers, the school heads, were given a free hand to choose what occupation should be taught. In other words there are no workshops, no moneys was given to purchase sophisticated equipments. In an urban area the children are taken to an adjoining motor vehicle repair shop or a bicycle repair shop and are then allowed to do actual repair and the motor vehicle repair technician is brought into the classroom one day in the week to teach the students the theoretical content and for practical they are taken to the adjoining workshop. In the coastal belt area, the children are taken out to the fishing area itself they are put on the boat, they are taught how to repair a small boat, how to work with the fishermen, they learn how the fishermen live, their social conditions, etc. This is the pattern of occupational studies which has been drawn up and taught compulsorily to all the children. The curricula is drawn up by the teachers or several teachers in the region getting together and as part of it technical drawing is compulsorily taught to all the children right throughout the islands. So this is what Mr. Parvez was referring as occupational studies which we introduced from January 1972, functioning satisfactorily upto now. The Government has not spent too much money on this, actually no money is voted for equipment as such. This is why yesterday when I referred to integrating technical education with general education I thought it was not possible because when we say technical education, at least technician education we thought we are referring to specialised education which would come much later. What we are attempting in Sri Lanka is to condition the student, and introduce and infuse healthy attitudes towards technical jobs and technicians assignments.

MURUGASU: While congratulating the two speakers for their good papers I would like in particular to direct my questions at Mr. Parvez. The two points I have in mind are of immediate concern to us because of late in our division in Malaysia in particular there has been discussions as to what extent general education should form a component in vocational education. We have actually reduced the amount of general education to 20 percent and there is a general feeling that this percentage could perhaps be reduced even further. But from the recommendations of Mr. Parvez and also the comments from Mr. Pala I see the consensus is that general education should in fact be increased and I noticed that emphasis is in fact being placed to introduce humanities even at the technician level. The point that I wish to clarify from delegates as well as from Mr. Parvez is whether it would be safe to cut down further the component of general education that is now being provided in our vocational schools from 20 percent to a lower percentage. My second question is whether vocational education as it is provided in our schools for the 10th and 11th year should be terminal. But I see from the thesis presented by Mr. Parvez that vocational education or technical education, or technician education for that matter, is anything but terminal.

PARVEZ: Actually there is no standard formula which can be prescribed as to how much percentage of general education should be provided in technician curricula but I believe 20 percent is the correct figure that I understood. When I said that I was thinking somewhere between 15 and 20 percent. Now what general education should be given would largely depend upon each country according to the local context. But the main idea is to familiarise himself with two major aspects (i) world of work itself which means coccupational guidance, what jobs are available, how industry works, what is the relationship between industry and institute, industry and government and other agencies, autonomous, semi-autonomous and (ii) the social guidance part which includes sociology, psychology, understanding of workers. One of the major, I should say, weaknesses of a technician is his lack of communication skills. If this is improved in terms of both language, presentation and report writing, this would give him the necessary confidence to make his presence felt and to advance in his career. If in Malaysia you are giving 20 percent I think the need may be there to review it and make it more relevant. Regarding your second question sometimes I was also of the same opinion that there should be an educational regimentation in the school system because everybody wants to go to college and I thought some sort of a drafting may be necessary according to aptitudes and capabilities of the boys so that there are certain cut off points and according to their capabilities and further potential, for instance, we may have a multi-level institution, certain people are cut off at the skilled worker level, others go to technician level and from there the pick of them go to the higher professional and technologist level but on thinking and hindsight, discussing things and looking at the democratic and cultural aspirations in a country, I think it does not work and it would not work. So I am not saying that the whole educational pyramid or the system should be so fluid that one graduate from one school goes to another and then goes to another. This would be a very expensive way of training. Actually you would be spending on this man, first his training as a skilled worker, then as a technician, then the same person you take as a technologist or a professional. But what I am suggesting is that the doors of future education, higher education further on should not be closed to the technician at least to some segment of them who are really enterprising and who want to learn more. And for these people only I would like to have some avenues of re-entry into the educational system.

SARUVA: In Papua New Guinea our Department of Education undertook to offer technician courses very recently, as recently as 1972. So our courses in technician education and training is very new. Of the few technicians we have produced, it is not uncommon to see these few technicians, on completion of their training, to get into administrative and managerial roles. I was just wondering whether this has happened or is happening in other countries of South-East Asia or whether it is unique in Papua New Guinea. If it is unique in Papua New Guinea I am not quite sure whether we should be jumping up and down with happiness or start seriously thinking of other alternatives. This has come up because of the rate of localisation in Papua New Guinea and I suppose there is a need for such a situation.

WAHYUDI: I agree with Mr. Parvez. I would advocate as in page 25, paragraph 6, about good grounding in science and mathematics and so forth. In my country we had many problems before 1969. We have many technical schools, senior and junior, which grew rapidly. As a result we had to work out the relevancies, efficiencies and effectiveness of these courses offered by these schools. In the senior technical schools before 1969 there was about 8 percent practice, so many senior technical schools could not produce good technicians or qualified technicians. Now in national development planning we are establishing new pioneer projects of senior technical schools. We want to establish greater relevance between technical schools and technical manpower needed. The ratio now is 40 percent practice and 60 percent theory. To benefit us we use the four year system. This new idea come from experiences. But there is one problem, many people are not attracted to the blue-collar jobs. May be I want some suggestion from Brigadier Connelly as to how to make people more attractive to change attitudes to, as I said, the blue-collar job. My question is first "How to change the attitudes of people to make them attracted to blue-collar jobs" and second "What is the desirable percentage between theory and practice".

CONNELLY: I am afraid I was not supposed to answer the question about curriculum but I think I have exhausted my ways of showing how the job can be made attractive in my paper. I have said that chiefly through the associations can the technician job be made more attractive to the public if you like. The other ways I have mentioned I do not think I need to elaborate. While I am on the microphone I might reply to my friend from Papua New Guinea that theirs is not a problem only for South and South-East Asia where people take a university degree in engineering and then go into administration but we had complaints from the Dean of Engineering, University in Ottawa, that graduates in engineering going in straight to Master's degree in business administration and that engineering is not being practised.

PARVEZ: I wish I know the complete answers regarding the change in attitudes. This is an uphill task. Actually I think we as educators are also at some fault, we have not been very imaginative in our public relation in selling our products. After all we are manufacturers of technicians so to say and we should have been a little more persistent. We are doing every bit individually but the collective effort is lacking. Of course the education of the community, invitation of industry and community leaders to the school, making the school or the technical institutes a community centre, arranging conferences, giving radio talks, T.V. shows and there are so many ways. But I think there is no single strategy, it is a long process, attitude for changes, this is a very big formidable problem. But I think partly for preparing the technicians changing his attitudes is also very important because he has to sell himself also when he goes to the industry. If he takes a passive role nobody is going to recognise him. We have to teach him initiative, we have to inculcate in him qualities of leadership, we have to improve his communication skills, and so on. So it is a joint effort from everybody and the only thing is to begin somewhere. As regards your second questions, I do not like to give any single formula or any single figure. I refer you back to my friend from Singapore, who always make most appropriate and valid observations so far that I have heard. One of his observations was that you have to design a curriculum according to the local needs. If the industry wants, more skills, less cognition, produce it. If the industry wants more cognition, less skills, produce it. This is not the final thing, you have always to update and evaluate the programme, get the feedback, adjust it, make corrections and take remedial action. This is an evolving thing it does not remain static. As the country progresses the whole specification of your technician would change. So I suggest that you relate it to your context in your country and accordingly you can find out whether it is 60 percent, 40 percent, 30 percent, 70 percent, I cannot think of any uniform formula for that.

CHAIRMAN: I would like to make a few observations not that I choose it at the last minute so that the two gentlemen would not have a chance to reply to it. But I think tomorrow we have longer time for discussion on the papers presented, so I would like you all to consider this and we will discuss the matters tomorrow. First I feel that all of us realise that there is very little recognition of the technician. We want the technician to be given degrees or diplomas, there must be a recognition along that line, whereas we are saying that we are giving too much attention to paper qualification. And from Brigadier Connelly's paper he even mentioned about in England a foreman is recognised by his bowler hat, and collar and tie. I do not know whether he is saying that in a very light vein but we must not go for the saying that a clean hand is better than a dirty hand. Now I am not quite sure where we are heading for. But I feel as all of us agree it is a matter of attitude. An attitude developed for so many years in this area and these attitudes were existing before in most of the developed countries and what we are trying to do is to achieve something within four or five years which has been achieved in the developed countries over a period of may be 50 to 60 years. It is not possible. At the same time I feel that we are thinking too much in the material sense, in that we are talking about better wages and amenities. We want typical type of recognition in the sense that if we recognise an engineer today by his institution, by his degree, we want that to be accorded also to the technician. So if we are going to raise the status of a technician as such then the craftsman will also move for similar recognition. If the technician gets higher pay then the engineers and the technologists will say that their pay should be much more than what they are getting now because the technician has gone up. I may be a little philosophical here but if we think that men are men whether he is a technician, whether he is an engineer or he is a scientist, we are just ordinary human beings. If you have that attitude I think the question of status would not really bother us so much.

AN ANALYSIS OF MAJOR ISSUES INVOLVED IN PLANNING AND IMPLEMENTATION, AND IDENTIFICATION OF MAIN AREAS OF RESEARCH AND INNOVATIONS

by

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How to plan for technical education and training in our countries? What are the main areas of research and innovations in technical education to improve the quality and standards of engineers and technicians?

Till these questions are actually asked few persons pause to think of technical education as a system of many inter-acting forces, which demands coordinated planning and implementation. The common assumption is that given a good teacher a good student, a set syllabus and of course, plenty of money, technical education occurs automatically. Nothing can be farther from truth than this simplistic approach to a vital sector of human resource development.

Human Resource Development

Let us consider the issue in its correct perspective. Many factors influence the pace and direction of the progress of a country. Industry, foreign trade, government, social institutions are all important, but nothing is more important than man himself. In the final analysis it is the ambitions and know how of a people which determine whether minerals stay underground or are transformed into articles useful to man; whether oil remains hidden or is converted into energy; whether roads remain mud-tracks or are made into arteries of trade and commerce; whether people will have better food, better housing and better health.

All development studies must therefore recognise the importance of the human factor—the education, training and energising of human resources.

The classical economists recognised the importance of human resource development a long time ago. Adam Smith stressed the importance of education in "The Wealth of Nations" and specifically included "the acquired and useful abilities of all the inhabitants or members of Society" in his concept of "Fixed Capital".

> "The acquisition of such talents by the maintenance of the acquirer during his education. Study, or apprenticeship, always costs a real expense, which is a capital fixed and realised, as it were, in his person. Those talents as they make a part of his fortune, so do they likewise of that of the Society to which he belongs".

Marshall emphasised the importance of education "as a national investment" and believed that "the most valuable of all capital is that invested in human beings".

Unfortunately, later day economists were preoccupied with other factors, like physical capital and capital-output relationships which are all measurable and can be quantified. They overlooked the importance of human resource development in the economic growth processes and believed that entrepreneurial expertise by a minority and belt-tightening by a majority to provide savings for investment would together stimulate economic growth.

But capital accumulation is by no means the sole factor in economic development. In fact, even in the developed countries in the twentieth century, output growth in physical capital exceeded imput growth on the average by 3.5 percent to 1.9 percent. A recent study has indicated that between 1900 and 1957 only 10 percent of the growth in U.S.A. could be explained by increases in labour and capital. This makes it clear that factors, other than physical capital are necessary for growth. The most important of the residual factors is improvement in the quality of labour force resulting from education. Modern economists have therefore started re-discovering the importance of human resources, and particularly of investment in education and as an integral part of economic analysis of developmental processes. This view, now widely held, is best expressed by Theodore W. Schulz in his presidential address to the American Economic Association in 1960:

> "The failure to treat human resources explicitly as a form of capital, as a produced means of production, as the product of investment, has fostered the pretention of the classical notion of labour as a capacity to do manual work requiring little knowledge and skill, a capacity with which, according to this notion, labourers are endowed about equally. This notion of labour was wrong in the classical period and it is patently wrong now. Counting individuals who can and want to work and treating such count as a measure of the quantity of our economic factor is no more meaningful than it would be to count the number of all manner of machines to determine their economic importance either as a stock of capital or a flow of productive services".

All recent studies on the economic analysis of investment in man are a significant contribution to economic theory, but there are still wide differences among economists on the priority to be assigned to education, training and other aspects of development of the capacities of people in economic development plans. Some argue that only a part of investment in education is "economic" since it promotes economic growth directly, and all the rest of the expenditure is primarily "social investment" and should therefore be determined residually. To accept this argument is to take the restricted a view of human resources development. True, the central purpose of education and other means of human resource development is not merely to maximise man's contribution to the production of goods and services needed by the community. It extends to his cultural, political and social aspirations, that is to his total growth and development as a man. These two, however, are not mutually-exclusive, since the goal of all liberal modern societies is to achieve a balanced development of individuals concurrently with their rapid economic progress. One is the logical corollary of the other and a total integrated view has to be taken of the processes of development.

All these and more imply that manpower planning is an essential element of national development policy, whether we see it as a means of building up the skills, knowledge and competences required for economic development or of providing the individual with productive and socially useful employment. It is no longer a question of *why* we plan for that is axiomatic; it is *how* we plan.

Human resource development is both a continuous and multi-faceted process. At each stage, the process has to respond to the economic and social goals that we have set ourselves on our march towards development and as we strive to equip our people with the knowledge, competences and skills that they need to reach those goals. The state of science and technology in our country and how they are applied generally to economic activities determine the level and extent to which our human resources need to be developed. Fducation is not merely an instrument of both economic and social change; it represents an investment in human capital. It must help our people towards a better quality of life. The process also demands identification of critical manpower groups, like engineers, scientists, technicians and skilled workers, estimation of the demand for them for various developmental activities and establishment of adequate educational and training resources to match the supply with the demand. Moving further, human resource development encompasses the entire labour force in the country to promote its effective participation in productive economic activity.

Methodological Approaches To Manpower Planning

It is within this broad conceptual framework that we must plan for technical education. To this end, we must identify the problems of planning processes *vis a vis* national development objectives and gain insights through research which will help us in solving the problems.

The first task is to develop suitable methodological approaches to technical manpower assessment of demand and supply. Decisions on such important issues as, what are the different categories of technical manpower and how many persons in each category are needed, to what extent technical education and training should be expanded at different levels and so on, will depend upon a correct manpower assessment. More important, manpower assessment must be made far in advance of the time when technical personnel is actually needed, because it takes at least five years to train an engineer and three years to train a technician.

Take India. Since the country undertook national development in 1951/52 through successive Five-Year Plans, the Government also estimated the demand for technical manpower for each successive plan and expanded technical education and training accordingly. For this purpose, through research and other studies new methodologies and techniques of manpower assessment were developed, which may be summarised as below:

(*a*) Normative Relationships: in this methodology, Production-manpower ratios were established for each sector of economic activity and on the basis of those ratios manpower demand estimates were projected *vis a vis* the physical targets of each Plan.

(*b*) Investment-Employment Relationships: in this methodology, field studies were carried out to estimate the employment of technical personnel for each unit of investment in different sectors of economic activity and the manpower demands projected *vis-a-vis* investments proposed in each Plan.

(*c*) Output-Employment Relationships: in this methodology a time series was constructed for the value added at constant price level in each sector and employment, and a regression equation developed to project manpower demand for different sectors.

(*d*) GNP Growth Rate-Manpower Stock Growth Rate Relationships: in this methodology a relationship is established on the basis of past data between the growth rate in different sectors of national economy, which are dependent on technical manpower and the total stock of technical manpower. This relationship is used to project manpower demands *vis a vis* economic growth rates visualised during a particular plan period.

These and other methodologies are generalised approaches to manpower planning, but they need to be refined and improved before they are applied to situations in any other country. It is here that research, including extensive field investigations are indicated.

Education-Occupation Matrices

The next task is to develop Education-Occupation Matrices for different economic sectors where technical manpower is employed. Although there is no unique relationship between education and employment, it is necessary to establish correlations between different levels and kinds of empolyment of technical personnel, and the types of education or training or practical experience needed. Education-Occupation matrices interpolated with manpower-demand projections provide much valuable information which will help us in deciding the various types of education or training facilities which need to be organised to meet manpower demands.

The first step towards Education-Occupation matrices is to prepare for each-country a national classification of occupations in the primary, secondary and tertiary sectors of the national economy. This demands a team of occupation analysts to study in detail the different occupations, classify them into appropriate categories and sub-categories and describe their functions and job-requirements. For instance, in India, we have prepared a National Classification of Occupations covering over 5000 occupations at five digit level, along with a detailed description of each occupation. Based on this National Classification of Occupations we have prepared Occupation-Education matrices as a time series for a twelve-year period, 1960-72. For this purpose, an Employment Market Survey is conducted each year of all establishments, both in the public and in the private sectors of the national economy, which provides detailed information regarding the number of positions in each establishment according to the National Classification of Occupations, number of employees, educational/training qualifications of the employees and other aspects. Education-Occupation time series also provides valuable information regarding the changes in the structure of industry, nature and level of employment, technological changes and a host of other factors of importance to technical manpower planning.

Activity Analysis

The third task is to carry out an Activity Analysis of technical manpower in employment and prepare an activity profile of engineers, technicians and skilled workers, both at different levels of their employment and for different parts of the time span of their professional career. For this purpose, engineering occupations of allied nature must be grouped together to form clusters and a clear understanding of the functional requirements of each cluster developed. The understanding must be expressed in terms of technical/professional knowledge, skills and competences for different jobs. The main purpose of activity analysis is:

(*a*) to evolve goals of engineering education and relate them to educational and training systems;

(*b*) to provide the much-needed basic information about the job requirements of engineering occupations to help in curriculum development;

(*c*) to determine the complementary role of industry in equipping fresh engineers, technicians and skilled workers with the practical experience/skills needed by them; and

(*d*) to estimate the costs of engineering education *vis-a-vis* employment requirements to avoid over-capitalisation of engineering education systems.

The methodologies of activity analysis must be developed with specific regard to the conditions obtaining in each country. Generally, however, these include (a) questionnaire survey of the activity of engineers, technicians and skilled workers at different levels in design and development, production/construction, supervision/management and other related professional duties and responsibilities; (b) equipment and processes used in a stratified sample of establishments as indicators of technology level and relating them to the knowledge, competence and skills that engineers, technicians and skilled workers must possess; and (c) identifying the product-mixes in all sectors of national economy and delineating the exact functions of engineers, technicians and skilled workers *vis-a-vis* those product-mixes. (Here in addition to goods, the services rendered to a community, like supply of electricity and water transport, communications, housing, etc., are to be included in the product-mixes which are technology-based).

These three areas—Estimating the demand for and supply of technical manpower, preparing education-occupation matrices and carrying out an activity analysis are of prime importance to technical education planning processes and policy formulations. Methodologies and techniques must be developed through research and field investigations which have their own integrity and reflect the special circumstances obtaining in each country. The methodologies and techniques developed must be sensitive to not merely technological changes; they must respond to the changing socio-economic forces in each country.

Technical Education System and Its Interactions With Other Systems

Moving further, we must visualise technical education as a system with its own input-output factors and performance indicators. The system also interacts with other systems and thus becomes a complex human activity.

The system of technical education and its interactions with other systems may be represented as in Chart I.

Technical education system first interacts with the socio-economic system of a country at various points. The latter includes the society with its own aspirations, urges and goals to which technical education must respond. As the socio-economic aspirations of a people rise, the society demands increasing application of science and technology on a broad front and as a sequel, technical education facilities must expand. Technical education also influences the attitudes, values and style of life of a people and thus, compels the society to make increasing investments in its system.

Industry is an important component of the socio-economic system and its main employment-generating source for the products of technical education. Technical education system interacts therefore with industry in a variety of ways. These include, training different types and levels of the technical manpower needed, adjusting/modifying curricular offerings in line with the requirements of industry, undertaking research/investigations on problems referred by industry, providing further education and updating and refresher courses to persons working in industry and so on. In the reverse direction industry's interaction with technical education includes such aspects as: advising technical institutions about manpower requirements and the types of curricular offerings needed, providing practical training to students to complement theoretical instruction in institutions (through sandwich courses or co-operative engineering programmes), providing the services of experts in industry as part-time or visiting teachers to institutions, extending facilities in industry to teachers to gain adequate practical experience, farming out projects to institutions for research/investigations. In fact, technical education-industry co-operation and collaboration is one of the vital factors in technical education development.

The third system with which technical education interacts is non-formal education and training. It is in this system that a great part of human resource development takes place through in-service training, apprenticeship and other forms. Unfortunately, many developing countries have not realised the potentiality of this system and are extending too much concern to the formal education system. The latter is expensive, demands large capital investments and other resources and does not adapt itself quickly to technological and social changes. The non-formal system uses the resources of industry, is less expensive, adapts itself more readily to industry's needs and more important, its rate of return is higher. All this is not to deny the formal system its due importance, but to emphasise how equally important it is to develop the non-formal education and training system and to establish co-ordination with the formal system. Co-ordination between the two systems includes: providing part-time theoretical instruction in technical institutions for apprentices in industry; providing part-time courses for degree/diploma/certificate for apprentices or employees in industry; developing suitable instructional materials and testing and evaluation procedures for in-service training and apprenticeship. There are many other ways in which coordination between the two systems may be promoted. For instance, depending upon the technology level of a country it may be possible to train some types of technical manpower, including middle level technicians mainly through well organised apprenticeship. Apprenticeship is also an important means of equipping the products of the formal system with practical experience to condition them for gainful employment. All these and more implies that both systems should complement each other to contribute effectively to human resource development.

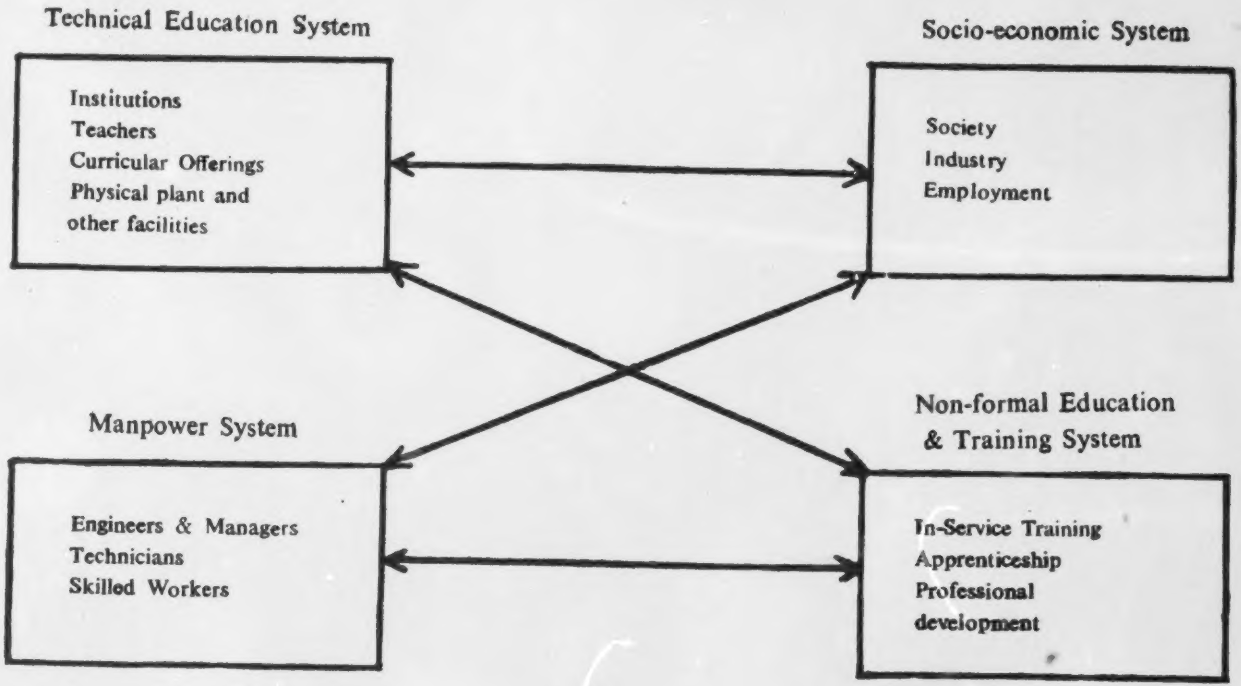
Lastly, technical education interacts with manpower system which consists of engineers, managers, technicians and skilled workers who are all the products of the systems of technical education and training both formal and non-formal. It is from this stock of manpower that the technical education system gets its teachers, instructors and a host of other key personnel to make the system function. Thus, the products of technical education are recycled into the system and thus starts the interaction between the two systems. The higher, the quality and standard of the technical education system the better the quality of the manpower system and the latter further influences the technical education system through the recycling process. The manpower system does not consist merely of individuals or groups of individuals. There is a functional and quantitative relationship among engineers, technicians and skilled workers. It is also to these relationships that technical education as a system must respond.

The more important interaction between technical education and manpower system is through the socio-economic system. Engineers, technicians and skilled workers are the prime movers of the economic life of a country and constitute therefore an important segment of the society. In this role, they influence the attitudes, values and aspirations of the society as a whole and, as a sequel, the pace and direction of the progress of technical education. As the proportion of this manpower group in the total working population of a country increases there is an increasing awareness of the importance of the application of science and technology on a broad front. This generates more demand for technical education and training and the society prepares itself to make more investments in the educational system.

Technical education system includes four major inputs, viz. institutions with physical plant and equipment, teachers, students and curricular offerings. In the final analysis, the performance of the system depends upon the quality of these inputs and how well they are co-ordinated. On its performance too depends its interactions with other systems. For instance, the curricular offerings are not merely an educational process to equip students with well defined technological knowledge and skills; they are a means to reach the broader goals of engineering education which reflect the socio-economic aspirations of a people too. The design of the curricula for different types of technical manpower is therefore important. On that depends, how the technical education system produces the correct types of manpower needed by industry on the one hand, and on other, how it responds to other forces of the total socio-economic system.

The teacher is the heart of any educational system, because it is he who optimises the utilisation of all the other inputs into the system. There are also other important aspects of the problem of a technical teacher. He must have a sound knowledge of his own subject-field and be trained in pedagogical processes. In addition, he must have adequate practical experience in his field to give the much-needed practical orientation to his teaching, and prepare students suitably for their professional challenges. Further, he must be aware fully of the total goals of engineering education

TECHNICAL EDUCATION SYSTEM AND ITS INTERACTIONS WITH OTHER SYSTEMS


Technical Education System
Institutions
Teachers
Curricular Offerings
Physical plant and
other facilities
Socio-economic System
Society
Industry
Employment
Manpower System
Engineers & Managers
Technicians
Skilled Workers
Non-formal Education
& Training System
In-Service Training
Apprenticeship
Professional
development

and how they are influenced by the socio-economic system of his country. More, he must have practical economic sense to maximise the cost-benefit relationship of the system of which he is responsible.

The other inputs of the technical education system like physical plant and equipment and operating costs are derived from the socio-economic system and constitute a direct charge to the state. Economics of technical education is therefore an important factor which affects not merely the other inputs into the system; it is equally important in national policy formulations. Like all education, technical education feeding upon itself generates its own dynamics. The more the demand for education the more the costs and someone has to pay for it. Ultimately, it is all a question how much education must be provided. There is, a limit to the resources available and more so, in the developing world.

Finally, students as an input into technical education are also the final product of the system and the ultimate performance of the system must be judged by the quality of the product. The educational standards of the students admitted to different courses, their motivation, capacity to adjust and adapt themselves to new situations, commitment to ideals and so on are all important factors, because on them depends the effectiveness of curriculum, teachers and other processes of the system.

From this analysis of technical education as a system and its interactions with other systems we may identify the main areas of research and innovations:

Curriculum Design and Development, including Evaluation

Engineering curriculum must reflect the goals of engineering education, in the first instance. Next, it must explain the educational processes through which students will be equipped with the knowledge, competence and skills needed for their future professional work. Thirdly, the curriculum must show the logical relationships of the different components like social sciences and humanities, basic sciences and mathematics, engineering sciences, technical arts, engineering speciality, etc., which constitute the total course content. Finally, it must develop fundamental concepts and understandings in the students and make the students integrate theory with practice and apply them to practical problems in engineering.

Unfortunately, in many developing countries little attempt has been made towards curriculum design and development on these lines. Most curricula, whether for engineer courses or for technician courses have been formulated by the "scissors and paste pot" method, cutting and pasting from the curricula of institutions in other countries. They hardly reflect how an engineer or technician needs to be trained to meet the current and future requirements of the countries concerned. There is also evidence of too much padding [illegible] the curricula to make the courses appear impressive.

For all countries, and more so, for developing countries, curriculum design and development must be a main area of continuous research and innovation. In this enterprise, teachers, educational experts and experts in industry must work together on a co-operative basis and evolve their own methodologies and techniques of curriculum design and development. An important step, however, is to carry out an activity analysis of engineers and technicians, as described earlier and develop activity profiles which will help in identifying the correct relationships between curriculum content and the job requirements of different engineering occupations. We must also bear in mind that technology advances at a fast rate and engineers and technicians will be called upon to face new and unfamiliar situations. Education must therefore have a futuristic approach and prepare students for all these challenges in their long professional career. This demands a correct balance between the practice of current techniques and skills and acquisition of fundamental knowledge which is transferable to new situations.

Many developing societies are applying modern technology for the first time in their economic life. The success of their efforts depends upon how they *manage* the application of technology *vis-a-vis* their socio-economic goals and minimise the danger of disruption of their basic values and culture. Technology must not be regarded as an imported magic to transform a traditional society into modernity. It must be practiced with great care and deliberation. Our engineers and technicians must therefore be aware of the social consequences of their technological actions and capable of facilitating a peaceful change in the socio-economic life of their own people. All this and more demands that engineering curricula must have a socio-humanistic stem which will help students to gain a surer understanding of the society to which they belong and the social implications of technological changes. Further, they must be equipped with the communication, human relations and managerial skills which are so very necessary in their future professional life. Research is needed to determine how to integrate the purely technological component of the curriculum with socio-humanistic studies.

The purpose of engineering education is not merely to prepare an individual for a job. For many countries, it is also to develop entrepreneurial attitudes and skills which will help young men and women to start enterprises of their own and contribute to the economic life of their countries. The so-called pay-packet jobs are not increasing in proportion to the number of engineers and technicians trained by the educational system (notwithstanding all planning) and the unemployment situation in those countries must be met by well organised efforts to promote self-employment by encouraging technically trained persons to start small and medium industrial enterprises. An innovative approach to curriculum development is therefore needed.

Workshop and Laboratory Practice

Practical work in workshops and laboratories constitutes an important part of all engineering curriculum. The purpose of workshop training is to equip the students with a knowledge of the properties of engineering materials and the processes involved in changing their form and shape, design, construction and operation of tools and machines and to develop in them various operative skills which are basic to engineering construction or production.

The purpose of laboratory practicals is to develop in the students experimental analysis and verification of scientific principles and their application to engineering. Laboratory practicals reinforce classroom instruction for a better understanding of theoretical principles underlying engineering and thus lead the students to investigative approaches to problem solving.

In view of the importance of practical work all engineering institutions make large investments in equipping their laboratories and workshops.

How to plan the workshops and laboratories, what types of equipment, instruments and apparatus should be provided, how to relate practical work to theoretical instruction in different subjects, how to design the practical exercises and so on, are all important problems to which we must pay special attention. Research and innovative approaches to these problems are needed to develop in the students originality and creativity which will help them in engineering design, construction, production and testing. For instance, in many institutions students are made to carry out set experiments in laboratories according to well laid out procedures, take readings/observations, make calculations on the basis of known formulae and give the final results which are only too well known. Such exercises hardly help to develop in the students any experimental ability for investigative type of approach to new problems. They also do not make for any originality or creativity in the students. A radical departure from this type of laboratory practicals is needed. To give the students a new type of laboratory experience open-ended problems must be set and the students given an opportunity to design the experiments, set up the relevant experimental assembly and carry out the investigations. Similarly, a series of modules may be developed for workshop training to build up a variety of operative skills in stages.

Textbooks, Instructional Materials, including Laboratory Guides

Apiece with curriculum design is the preparation of textbooks, instructional materials, including teachers' guides laboratory and workshop manuals and more important, teaching units for different subjects. Here too, many developing countries, engineering institutions are depending heavily upon the textbooks and instructional materials produced in other countries where the conditions are totally different and as such, the educational processes in the institutions are merely imitative. This is an important area of research which demands organised and sustained efforts on the part of the faculty of institutions. The instructional materials developed must be tried out in actual classroom situations, feedback obtained and improved on a continuing basis. This also constitutes an essential step in the evaluation of the curricula which have been designed and developed for engineering courses.

Examinations and Assessment

The culmination of all teaching and learning processes is in examinations to assess the performance of students. Performance results also indicate how effective has teaching been. We must therefore evolve correct examination systems which will not test the cramming powers and bookish knowledge of students, but the depth of their understanding of the fundamentals of different subject-fields, problem-solving ability and analytic powers. Engineering education must also develop in the students a capacity for synthesis which is so very essential to design and developmental work. The type of examinations evolved must test this capacity of students.

Examinations must not be one shot affair at the end of each course year, but a continuous assessment of the performance of students at well defined stages. The assessment should indicate to the students the progress of their studies and how to make up deficiencies. To this end, appropriate instruments of testing and evaluation must be developed.

Technical Institution—Industry Co-operation

This is an area in which many innovations are needed, because the products of the educational system must be acceptable to the employment system on the one hand, and on the other, the resources of industry must be utilised to reinforce the efforts of engineering institutions to train the correct types of engineers and technicians. A common complaint of industry is that the products of the educational system are too theoretical, that they lack adequate practical experience and that they do not adapt themselves readily to industrial environment. True, but industry should not be merely a consumer of the products of the educational system; it must participate in the education and training of engineers and technicians. There are many ways in which industry may play this role. First, it must assist the faculty of engineering institutions in curriculum design and development so that the curriculum reflects the expectations of industry from the educational system. Second, it must depute its specialists to institutions to teach selected subject fields which require industrial experience for adequate treatment. Third, industry must encourage the faculty of institutions to spend stated periods in its design, construction and production units to gain practical experience and thus improve the quality of teaching. Fourth, it must offer its equipment and other facilities which are not readily available in the institutions so that students may work and learn under real industrial conditions.

The most important form of co-operation between industry and technical institutions is Sandwich Courses in which a student spends stated periods in industry and in his institution, alternatively. In this arrangement in which industry and institutions complement each other's effort, a student learns how theory is applied to practice in the design office, on the shopfloor and in the field and gains practical experience of engineering work under actual industrial conditions. In addition, he imbibes something of industrial culture which facilitates his transition from college to the world of work. Further, Sandwich Courses utilise the resources of industry to reinforce those of institutions to train the correct types of engineers and technicians needed by industry.

There are different types of Sandwich Courses, like "thin sandwiches", "thick sandwiches" and so on, depending upon the length of time spent in each layer of institute studies and industrial training, but all of them have the same basic principle of integrating closely theory and practice in a unified educational process.

Sandwich courses and other forms of technical institute-industry co-operation are all innovations of far-reaching importance to engineering education. All developing countries must evolve and adopt the innovations which are best suited to their own conditions.

Educational Technology

The engineering curriculum designed by an institute and the instructional materials prepared must be supported by suitable teaching methods and techniques

Straight lecturing followed by tutorials and home assignments have their place in the educational process, but their effectiveness is enhanced by educational technology which provides a variety of tools and techniques to accelerate learning. Charts and graphs, models (both working and cut out), films and filmstrips are some of the well-known teaching aids used by enginering institutions. Intensive efforts, however, are needed to develop all these materials according to curricular requirements and the teachers trained to use them on the widest scale possible.

Recently, Programmed Learning, Teaching Machines and Closed Circuit Television are coming into increasing prominence in educational processes. Many academics however, are sceptical of their usefulness at higher levels of education and regard them as "gimmicks" to cover up deficiencies in the scholarship and teaching ability of teachers. Nevertheless, it is important for us to investigate into the usefulness of these new educational media in engineering education and decide to what extent they may be used. We must remember that in many developing countries there is a big shortage of well trained technical teachers. Any innovations, new tools or techniques which will help existing teachers to do a better job must be welcome, provided that they are not expensive.

Cost of Engineering Education

Both for educational planners and administrators and for the faculty of engineering institutions, the cost of engineering education must be a matter of serious concern. When the resources of a country are limited and the demand for more buildings, more and better equipment, higher salaries and more operating budgets for institutions in increasing a correct balance must be struck between resource availability and requirements. This, however, is not to suggest that good education must be sacrificed for the sake of economy, but that the utilisation of available resources must be maximised. To this end, the cost of engineering education at the institutional level must be analysed and studied.

In this study, many conceptual issues are involved, as for instance, what are the direct educational costs which cannot be reduced below a minimum level necessary to maintain quality, what are the various overheads and what is the pattern of expenditure on them, how are the overheads related to direct educational items, what items of expenditure must be included under administration and how are they related to educational items. All these and other issues must be well defined and analysed to facilitate a study of costs in a rational way. In addition, the pattern of expenditure on various major items over a number of years must be developed to indicate the trends and how to control any runaway items of expenditure.

Teacher Training and Faculty Development

The heart of every educational institution is the teacher. It is the quality of staff that, in the final analysis, guarantees the success of an educational system. This is even more so for a technical institution where the nature of studies makes close contact between teacher and taught imperative and demands of the former to the academic excellence and professional competence.

The technical educational system produces its own teachers. True, but only up to a point. Our teachers have to come from the system itself, but to merely possess a degree or diploma does not make one a teacher. He must be trained and equipped for the purpose according to a well designed plan.

There are many components of technical teacher training and development. First, knowledge of subject-fields, which is the main function of the technical education system in producing graduates/diploma holders. Nevertheless, a further preparation to deepen the knowledge or improve it may be necessary depending upon the quality of teacher-recruits. Experience in many developing countries shows that the best products of the educational system join industry or go to other types of professional work and the teaching profession has to draw its members from the bottom layers. In such situations, the teacher-training programme must make adequate provision for subject training.

Next is methodologic and didactic preparation. It is assumed, but erroneously that all that a technical teacher needs is subject competence and he can shape himself into a good teacher through actual experience. Experience shows that all teachers, irrespective of their subject competence need to be trained in educational processes and methods and equipped with the necessary skills in an organised manner. This is equally necessary both for College teachers and for teachers of technician courses. The teachers must be trained not merely for classroom work; they must also be trained in planning, organising and developing laboratory practicals which constitute an important part of engineering curricula.

Third, all technical teachers must have relevant practical or industrial experience to reinforce their subject knowledge and be able to give the much-needed practical orientation to engineering education.

Finally, the teachers must be trained in curriculum design and development, preparation of instructional materials and educational technology.

Teacher training is therefore an important area of research and innovations. The pace and direction of progress of technical education in our countries depend upon the quality and quantity of the teacher training resources organised by us.

In addition to training new teachers, we must also pay special attention to faculty development to provide a wide range of opportunities to serving teachers to improve their professional competence on a continuing basis. Some teachers need shorter courses to update their knowledge in their special fields. Others need similar courses to acquaint themselves with the correct methodology of teaching their subjects, use of audio-visual aids or to develop laboratory experience along new lines. Yet others need opportunities to improve themselves in new directions, as for instance, industrial experience. These varying needs must be met by designing appropriate courses and enrichment programmes and offering them on a continuing basis. Teachers must be encouraged to avail themselves of these facilities and renovate themselves. A great deal of imagination is needed in designing the courses and conducting them.

Non-Formal Education

We have already indicated that the non-formal system of education is responsible for a substantial part of human resource development in all countries. Experience shows that this system grows steadily in response to a complex of socio-economic forces. There is therefore no question of fighting the system. On the other hand, we must understand all its various aspects and strengthen it by co-ordinating it with the resources of the formal system.

The most important aspect of the non-formal system is apprenticeship or training on-the-job which is not restricted to the training of skilled workers, but extends to engineers and technicians too.

There are many types of apprenticeship, each with its own distinctive features. In many countries, apprenticeship is controlled by national legislations which provide for contractual obligations, duration of training, basic training and related instruction payment of stipends, testing and certification and a host of other items which characterise an organised system. In some countries like Britain, apprenticeship legislation (in Britain it is called Industrial Training Act) also provides for a levy on industry which is used for training purposes. In addition, apprenticeship is reinforced by part-time, day-release and block-release provisions to enable apprentices to attend technical colleges and prepare themselves for degrees/diplomas/certificates.

In all developing countries, we must examine how to organise and develop apprenticeship systems in co-operation with industry. To this end, the main issues to be examined are: What types of engineers and technicians are best produced through apprenticeship to meet the needs of industry; What should be the duration of training and its broad contents; What should be the minimum general educational qualification for admission to apprenticeship; Should apprenticeship be wholly on-the-job training or should it include a minimum of basic training under controlled conditions; Should basic training be given in industry in separate training units or in a technical institution; What should be the content of related instruction in science, mathematics and engineering subjects relevant to the apprentices' fields of specialisation; How should related instruction be organised in co-operation with technical institutions and what types of releases like part-time, full day or block are most suitable; What types of examinations should be conducted for the apprentices and what awards, degrees/diplomas/certificates granted to them. Finally, wherever appropriate legislations do not exist, we must consider the desirability of bringing apprenticeship under state control and direction to ensure its progress along correct lines.

The educational system of a country will not have served its purpose unless it extends itself to the further education of engineers and technicians. Education is a life long process and as science and technology advance, existing knowledge and skills become obsolete and engineers and technicians need therefore to be retrained and equipped with new knowledge and skills to help them to cope with new challenges. Drastic technological changes too demand quick adaptability by engineers and technicians which is facilitated by continuing education.

Continuing education suffers if left to adhocism and unco-ordinated efforts. It must be organised according to a well conceived plan determined by the needs of each country. The process of planning includes: a detailed study of the state of technology in different sectors of national economy and how technology is applied to productive processes; projection of the development of technology over future years, both in terms of adopting or adapting known advanced technology and in terms of generating indigenous technology to suit country's needs; analysis of the education-occupation composition of engineers and technicians at work and the state of their knowledge, experience and skills. From this analysis we may identify the main areas of further education programmes to upgrade and equip our engineer and technicians to meet new challenges with confidence.

The plan as developed on these lines must be matched by developing adequate training resources. In this enterprise the faculty of technical institution must play an important role. In fact, further education must be regarded as one of their main functions. The curriculum, teaching methods and instructional materials must be specially developed. More important, there must be a follow-up of the participants to evaluate the effectiveness of the programmes and improve them on a continuing basis.

Conclusion

These are the main areas of research and innovations in technical education. Depending upon the state of development of technical education in each country, the problems may be elaborated further and additional problems suggested. What is important, however, is to identify and define the problems requiring research and investigations, with care and precision. The problems must be relevant to the conditions obtaining in each country and have their own integrity.

Some of the problems discussed in this paper cut across national boundaries and are generally common to the technical education systems of all countries. What distinguishes one country from another is the extent to which the problems are encountered and their complexity *vis-a-vis* national situations.

Educational research and innovations is a continuous process. As one set of problems is solved new problems arise and they demand renewed efforts on the part of all engaged in this enterprise. Adhocism must be eschewed since that will be a wasted effort and only clouds basic issues. A well organised and integrated set up with long range objectives is needed.

Research should not be for research's sake, an academic luxury, particularly in education. It must be directed to practical problems confronting a country and help the country to progress. The results of research must therefore be tested in the field and applied. Only then is the investment made in research justified.

Finally, research and innovations in technical education demand an interdisciplinary effort in which social scientists, statisticians, administrators must participate along with educational experts. It is in this collective quest that they will find their opportunities, challenges and rewards.

Discussion on Dr. Chandrakant's Paper

CHAIRMAN: Thank you Dr. Chandrakant, I think we have a very exhaustive analysis on the topic. Now I put it to you all for questioning or comments on the paper.

ASISTIN: May I refer to your approaches to manpower planning. In my country there was a time when the concept of education as an investment was the over-riding factor in getting the necessary funds for our educational system. But very lately education has been given a lower priority in our planning process simply because the concept of education as a social service came up. May I know from you when education is considered as an investment and when is education considered a social service.

CHANDRAKANT: I wonder whether there are two different stages, whether these two does not telescope in any developing situation or any developing country. There is a social demand for education which comes into interaction with the economic demand for education. Where precisely one stops and the other takes over is very difficult to say. Where education as a whole is concerned it has to be accepted that it is largely governed by the social demands, education in general. Where technical education is concerned it has to be looked at from an economic point of view, from the point of view of the demand for that one. The more you yield to the social demand for technical education at any level without regard to the economic demand, the more you have a chaotic situation and such chaotic situations are not unknown in some of the developing countries, certainly not unknown in India, where the social demand for technical education at some stage far outstripped the economic demand. I believe that such country has to make its own hard decisions and as Mr. Parvez pointed out these hard decisions are largely influenced by political conveniences and planners have to work within the constraints of the type that Mr. Parvez pointed out. But planners must have some instruments, certain methodological approaches to guide them and they cannot have an abosolute control over the system which is largely governed by considerations other than the purely educational or economic.

KOH: Dr. Chandrakant has laid emphasis on manpower planning and as the basis on which we design our technical education programmes. Now we feel that manpower planning is possible only in the case of the mature economy. In the case of the developing economies while we attempt to develop or draw up development plans, 5-year plans, 10-year plans and attempt to predict the directions in which our economy is going or attempt to determine the directions in which the economy is going. In the actual fact of life from the Singapore experience, even though it is so small, we have found that it is very difficult to predict where you are going. Now we look at the electronics and we say there is a future for the electronic industry and the conditions are ripe for the development of this sort of industry. Therefore, we attempt to look at the manpower requirements if the electronic industry develops and suddenly from no where we came up with this discovery of off-shore petroleum. I think Malaysia, the Chairman yesterday mentioned, were caught without the technicians to handle this. So in that kind of a situation what is the amount of dependance we can put on manpower projections in terms of manpower requirement.

CHANDRAKANT: You will pardon me if I do not subscribe to your assumption that manpower planning is possible only in a mature economy. I do not know whether there is a definition of a mature economy even from the point of view of an economist. All economies are developing. I do not think there is any economy, however, mature it is which is not developing. There is no economy which is at low levels of development which is not mature. I believe the use of the word mature economy is a little confusing to me personally. But I do believe that manpower planning is more important where the economy even in your own words is not mature. It is very important. Because if the future maturity of the economy depends upon manpower you must know what you are going to produce. You must know at what times you must produce. You must also know what quality it should be otherwise you will be caught napping and as the Chairman pointed out yesterday you have to go in for crash programmes. Now it is always dangerous to take up an example like sudden discovery of off-shore oil. I do not think that will change completely your planning approach, your planning process. But even there one should be aware of the possibility of oil being discovered and you must prepare yourself to meet the situation when it comes up. Otherwise you will have the problems of providing the right type of manpower and in adequate numbers. So you must permit me to say, or emphasise, that manpower planning is more important in the so-called non-mature economy. As an economy is maturing it is more important to make a manpower assessment, to make a study of manpower supply and demand because your entire technician education system will depend upon what you want to produce and to what purpose.

MURUGASU: Pardon me for asking a very naive question but Dr. Chandrakant while identifying methodologies to be used in manpower planning has not stated the actual agencies to be involved, may be because they are too obvious but perhaps some comments from Dr. Chandrakant may be useful. Because I am in particular thinking of situations where polytechnics are autonomous probably the situation is different in India where most of the 300 polytechnics probably come under the technical division of the Ministry of Education. If such a case exists I wonder where the responsibility should lie, whether it should lie in the form of a technical bureau itself or should there be a higher national planning commission. I ask this question because I foresee the difficulty if a university or a polytechnic or even a technical division in the ministry were to take upon itself the need to make projections and surveys in the next 10 or 15 years. For one thing the authority may be lacking and secondly the staff and the know-how and the processes necessary for down to earth accurate forecast may not be possible. So I shall be grateful to what extent the various bodies, institutions either they be national planning commissions or technical divisions or university should play. I know that no definite answer is possible but I shall be grateful for some guidelines, perhaps they may be of interest not only to me but also to others.

CHANDRAKANT: The primary responsibility for manpower assessment as a part of a national development plan will always be with the planning commission or the planning body in any country. Even in India it is the planning commission that is supposed to be in overall charge of the manpower aspects of national plans. That is at the macro-level but at the micro-level the level at which you plan for technician education, or engineering education, or training of skilled workers that is at the micro-level—at that level the responsibility should be that of the department or the agency that is concerned with technical education or technician education. Because it is there that you decide questions like how many new institutions should be started, what enrolment should be followed, what new courses should be formulated and implemented and a host of other things, that is at the micro-level and the micro-level planning responsibility to my mind, at least I hold this view very strongly even in my own country, that responsibility must be that of the department of education or the division of technical education in the department of education of the ministry of education. There will no doubt have to be close co-ordination between the macro-planning level, in the planning commission and at the micro-level mainly at the departmental level. The way in which this co-ordination should be brought about will certainly depend upon the situation in each country. The moment those who are in charge of technician education divest themselves of the responsibility of planning, they will be held responsible for all the mistakes committed by the Planning Commission. I was myself at the wrong end of the stick at one time.

PALA: This question was also discussed to some extent in the meeting we had in Manila on higher technician training. The participants of Thailand emphasised that there is a need for improved manpower surveys using clearly defined job specifications to reveal more accurate information on the needs of industry in terms of type, number and level of technicians. They say surveys have been carried out in the past but they do not get the right answers and people do not like to reply to the surveys—there is a need for improved manpower surveys better questionnaires as a help to manpower planning. I would like to hear Dr. Chandrakant's opinion on this and also his advice because I think in a large country as India they do this also on the basis of surveys being carried out.

CHANDRAKANT: I am thankful to Unesco for having emphasised a need for manpower surveys and the need to carry out what you call occupation analysis surveys. Now these are all integral to the whole business of developing a system of technician education that is relevant to the country and many of us at one time or another groped in the dark to know what type of technicians that we should produce and in that process we have merely copied from other countries. In my paper I have called it the scissors and paste pot method of developing the curriculum of a technician course. Now we must avoid that and we can avoid it only by carrying out on a continuing basis an occupational analysis of engineers, technicians and skilled workers. You have to watch the trends of changes too and your curriculum must respond to these changes. Even if you have to have a futuristic approach you must be clear about what is happening to the technological changes over a time period. This will apply more to a country which is at the middle level of development. If you were to ask about a country which has just started one has to start with certain axioms, certain assumptions and then modify as one goes along. One has to start somewhere.

LA SERRA: I would just do some comments about the question arising from the representative for Unesco and the answer given by Dr. Chandrakant. As a norm ILO is always insisting on putting in the training in technical co-operation programmes the components of manpower survey and manpower assessment because we are well convinced that no training programme can be implemented if we do not know what we must train. But unfortunately I must say that the reaction of the government is always opposite to this particular activity in our training projects first of all. So we have to spend a lot of efforts to convince the authorities that the assessment is always the first step before starting any training programmes. The second is that we must be prepared when we get the approval of the government or the authorities to get a lot of data if that completely fails we do not get absolutely any precise data, precise figures about what is really needed in the training programmes of the country's development. So we just do what we can. The assessment and the survey is to be carried out but we must be prepared to study and analyse it just enough to get our own conclusion and put the results before the national authorities involved in order to prepare a programme that is completely different from the data that we get from our service and through our assessment. Mine is just a comment—just to explain that it is very difficult to follow the right pattern that is so well explained in the Paper of Dr. Chandrakant and everybody must be prepared to take all the steps indicated.

HUQ: The concept of shared responsibility between industry and technological institutions Dr. Chandrakant has considered in his paper within a national context and I was wondering whether this could be extended to intra-regional or international context. By this I mean whether the industry of one country might provide some sort of training to technicians from other countries and in what form such a responsibility and co-operation could be extended.

CHANDRAKANT: I believe that this is one of the important functions of the Colombo Plan intra-regional activity. The intra-regional co-operation cannot merely be a wish, it has to be expressed in action. It is not merely in terms of providing places in a technician institution that this responsibility could be fulfilled. It must extend even to the provision of training places in developed industrial units for persons coming from developing countries. At least that is my personal view and I hope that the intra-regional co-operation concept itself should extend to your suggestion. Within a national context it is certainly a shared responsibility, in the context of intra-regional co-operation it is the spirit of co-operation that should influence this responsibility.

ANANTA: I have some little things in mind on the curriculum set up by the school. Dr. Chandrakant in his paper stresses that a technician education they should be well prepared to the curriculum arrangement at the very beginning. I feel that the curriculum will be established for any occupation. In our country we find that most of the schools and the educators would plan together what should be taught in the schools and what occupation should be prepared for the students. But it is very hard to get into the real needs of the occupations and also for the industry such as we are planning for the technical training in the degree level and most of the curriculum has been prepared by the teachers of the schools and will be investigated by the board of education and the committee who investigated or are investigating the curriculum all of them come from the university. So I can conclude that most of the curriculum has been planned by the educators from the schools or from the university even at the technician level. We find that such things will be a kind of taking a risk of preparing the students to meet the need of industry and it would take time for us to know what direction we are going. It would be at least three or four years before we can know whether we prepared the right manpower for industry or not. As Mr. Koh the delegate from Singapore mentioned this morning I am very interested on this point that the technician should be prepared or should be selected by the industry because they know that a man who can work within an industry in what capacity instead of the university people setting up the standard for them and this might be that type of technicians or you might say practical engineering or technologist or any type of thing. Now I feel we are lacking in the relationship between industry and the schools or universities in preparing the course or curriculum to meet the needs of the society. I do not know in other countries whether they have the same problems or not. When we are talking about industry or any other occupation we never had the people from the industry or any other occupation to share the ideas of people. I think that most of us are educators but I did not see any programme in here to get the idea from the industrialists or any other occupational people to tell what they think and what they have in mind for us to suggest research or other programmes to meet their needs. So I would like to suggest that in future meetings we should include some industrial occupational persons to share ideas in the meetings so we will know and set up the good programmes for both the industry and also for the education.

PALA: I am very glad that the representative of Thailand has made his remark because I made a similar remark this morning. I think it is very good for people like us when we share the table also with the industrialists. Most of them are not so very good talkers as we are and they do not know the game of education so well as Dr. Chandrakant who has been in this business for 30 years. I think we still can learn very much from the people who have come from the business and they can give us some right advice in this. I think that the remark from the delegate from Thailand is very good.

CONNELLY: I would like to point out that the national seminars that the Colombo Plan has organised throughout South and South-East Asia emphasises this point and actually in most of the meetings there were more industrialists than there were anybody else and we rather figured that those people who were coming to this Colloquium had already absorbed what they have learned in the national seminars. This has not been neglected in the past.

SEN: In Bangladesh the association of the industries and employers who are doing up these special courses when they need to exist. We sit together and we prepare the course outline according to their special need so the association is there but for the general type of training or education we ourselves do but for special types of training according to the needs of industry, their association is there. We prepare the curriculum according to their requirements.

MAISEMA: I think there has been a lot said about curriculum and curriculum to be assessed and modified and this can only be done by the continuous evaluation of the curriculum and to me evaluation requires specialist skills. I would just like to ask Dr. Chandrakant processes that could be followed in an institution where technician training is being carried out in co-operation with the industry, since we have been talking about industries taking greater responsibility to make sure that they produce good technicians. A workable method of integrating this with the process of evaluation of the courses which are being carried out in an institution or a college.

CHANDRAKANT: The development of a curriculum and its evaluation is a continuous process, there is no particular stage at which one can say this is complete. Because it is a process one must stop at a pre-determined point and to my mind the point really is, where technician education is concerned, a clear cut accurate analysis of the technician positions which will indicate to us the knowledge, the competence and the skills needed for a particular technician position from which you can derive the type of curriculum that should be structured. This has to be further evaluated in consultation with the experts in industry—that is where the part of the shared responsibility comes. The process of evaluation is when we get the feed-back from the industry because no curriculum maker can be satisfied that he has done his job satisfactorily unless he gets the feed-back that is where the evaluation process starts. You have to observe whether your curriculum that you have put across reflects adequately what the industry expects of the technician and you have to get back the feed-back from industry. So it is a cyclical process and as long as you visualise that it is a process, it is a continuous process, there is again the shared responsibility of the industry and the curriculum maker. It is wrong to conceive or suggest that curriculum development is the responsibility of a teacher or a group of teachers. At least in technician education it is a shared responsibility.

SESSION THREE

CHAIRMAN: MR. I. K. MCGREGOR

Discussion on Questions Arising from Working Papers

CHAIRMAN: There have been some questions circulated to you and the discussion will turn mainly on those questions. The first three relate to Mr. Ainuddin's paper and the fourth really comes out of Brigadier Connelly's Paper; fifth, sixth and seventh from the paper presented by Mr. Parvez and the remainder eight, nine and ten from Dr. Chandrakant's Paper. This will give you some idea where the sources of inspiration spring from. The set of questions is neither mutually exclusive of other questions nor collectively exhaustive of any that you may think of or that may be stimulated by the discussions. If we are going to present some coherent recommendations I suggest perhaps you might turn your attention principally to these questions. It does not however exclude some of the ones that I suggested might be asked or supplemented on Mr. Ainuddin's paper that he presented the other day and there were some questions that were suggested at the end of that session which might also be dealt with if you are so inclined. However, I think with those introductory remarks the field is open. We might start from the first.

Q. 1. "How can systems of technician education and training be developed to suit the particular socio-economic needs of regional member countries? Will such developments impede the promotion of intra-regional training and the transfer of technology?"

MUHIUDDIN: I think this question was raised basically by our fellow delegate from the Philippines. I think what agitated his mind was that how do we go for meeting our own needs and at the same time talk of some regional co-operation. It seems to me that the Staff College like the Singapore College have to cater to some common needs of the region as a whole. We should aim at some basic thing which is common to all the region and thereafter perhaps there could be courses suited to particular countries. There should be a basic minimum common to all the countries and not just the particular needs of a country. This should be ensured.

GUTIERREZ: I would like to get a clear definition of this term 'transfer of technology.' I would like to present two experiences we had, two developed countries helping one of our institutions in the Philippines. The developed country A had given us technical training in their country by inviting some of our instructors and then when the instructors came back they were given the facilities. The developed country B had a similar programme but when the participants came back they had all the facilities and there was a follow up of experts from that particular country who helped us to put up the machines or import machines. They were able to start a centralised tool-room for the common courses and seminars after seminars had been put up by this group. I would want to find out now which of the two groups had really put up or given us the transfer of technology. This is a term, which has never been defined very well by any group. So what is really the meaning of transfer of technology? Is it the Group A or the Group B as per my example?

MANANDHAR: I assume to make use of this intra-regional training programmes particularly like the Staff College. The Staff College should first have some basic study of the institutional infra-structure of the different countries so that they can devise courses which would be suitable for many of these countries.

CHANDRAKANT: The technician education system of a country must have its own integrity. It is not as though that it can prescribe a system that will be suitable or acceptable to a large group of countries. The system must grow out of a desire to develop the economy of a country. It has to be in harmony with the level of technology in that country, it has to be in accord with the socio-economic aspiration of the people and many other factors. That means in developing a system of technician education it is not merely a question of bodily transferring technology from one developed situation to another developing situation. It is not such an easy transfer at all. Technology must be integrated with the cultural, social, economic conditions obtaining in a particular country; otherwise this technician education will collapse, it would not grow. So the main emphasis is that each country must develop that system of technician education which will best serve its own purpose. Now the question is how to go about it. So many factors have to be identified. One is what precisely are the goals of socio-economic development of that particular country. Certain targets are necessary. Certain means of achieving the targets have to be identified, then you have to decide upon the type of manpower that you need, the numbers needed and the type of relationship that this technician education should have with the general education system. That is to say the input into the technical education system has to come from your general education system. So in developing a system of technician education for any country a variety of factors must be taken into account and it would not be quite appropriate for any country to transfer technology or transfer a technician education system "lock, stock and barrel" from one cultural socio-economic situation to another totally different situation. Therefore, a great deal of care and deliberation are needed in dealing with a problem of this type.

CHAIRMAN: The point what the Philippines delegation was after, and also the delegation from Nepal was would the Staff College be able to help in identifying those problems. If so, whether the Staff College could help in identifying that element in its research programmes and passing the results on to member countries.

ASISTIN: Last week the Staff College concluded its two week Study Conference for Senior Administrators and I think in that conference we came out with certain suggestions and recommendations on how the Staff College can meet the needs of member countries in this region. One of the many recommendations was the function of the College to monitor research activities in member countries and if possible to supply other countries with the results of such research activities. Another recommendation was that the Staff College would conduct this so-called in-country training programmes and all those who attended were in favour of this particular idea and there were a number of requests already put in, my country was one among them, for in-country training programmes. But the most important function according to the members of this Study Conference was for the College to conduct some kind of staff development programmes and curriculum design or curriculum development activities. This in a way would help other member countries in disseminating researches in Staff Development and Curriculum Development in technician education.

MANANDHAR: We have our own technical system where we develop our own plans and everything is there. I do not mean the Staff College should export its technology to all the developing countries. What I mean, is that it should function such that it would cater to the needs of all developing countries. It will be better if the Staff College try to understand the different institutional base that is created in different countries. That would be more helpful in disseminating all these information and conducting training programmes not that the Staff College should transfer the technology in its own total form.

CHAIRMAN: Your point is that it is directed more to the means of translating the technology rather than trying to import it unadulterated or unaltered into your own system. I think there is a basic difference between the two and it is generally recognised that socio-economic goals in various parts of the region differ widely and it is the way of translating them into the local idiom as it were that might well occupy the attention of the Staff College.

PASKARALINGAM: The question here is how can systems of technician education and training be developed to suit the needs of each country. There are some forms of technician education already functioning in the different member countries. The form it takes differs according to the political and socio-economic set up of each country. In Sri Lanka technician education is imparted through several institutions, we have the polytechnics and the technical schools. Various ministries carry out their own training, for example, the Ministry of Irrigation train irrigation technicians, the Electricity Board train electrical technicians, the Medical Department train their nurses and laboratory technicians. In another country, for example in Singapore, with a highly sophisticated and disciplined system they can expect the Singapore Polytechnic or other technical institutions to cater to the needs of the various industries. But, in our country it is very difficult to convince some of the other ministries to give up their training programmes and accept the technicians whom the Ministry of Education will produce. So the need and the pattern of technician education differ from country to country. It would be difficult for the Colombo Plan Staff College to study the set up in five different countries and go to the sixth country and say these are the patterns in the five different countries, therefore, please accept one or a combination of these. It would be very difficult. I do not think this is envisaged in this question. It very specifically asks how can systems of technician education and training be developed to suit the particular socio-economic needs of regional member countries. This, however, does not mean that the Colombo Plan Staff College do not have a role. They have. They can go to a particular country with expertise and study the problems there. They can help the planners and the directors of education to develop and improve on the pattern of technician education which is already functioning there to suit that particular socio-economic needs of the country. Their expertise will definitely be welcome in a particular country to improve on the pattern of technician education already functioning in that particular country. The developments in any country does not impede or do away the need for intra-regional training. There will always be a need for intra-regional training. Every country can gain from the expertise, for example, in Singapore the co-operation between industry and institutions may be very highly established. We can definitely gain by sending some of our teachers and other directors to gain some experience in Singapore and transfer technologies but within limited means.

MAISEMA : Developing a system of training would of course mean developing the physical facilities. Fiji is a small country within the South Pacific region and having very limited resources. With generous assistance from the member countries we were very fortunate to be benefiting from the Colombo Plan. I can remember way back in 1957 when I was in New Zealand there were students from Malaysia, Hongkong and India enjoying their training in New Zealand under the Colombo Plan and they seem to have plenty of money to spend apart from the poor Fijian students or the students who came from the South Pacific region. We have heard Dr. Chandrakant advising to put up facilities. Fiji has only one technical college. We are hoping to build another with the assistance of the British Government. It is very difficult to try and develop a system because of the difficulty of building extra facilities. At present we are only concentrating on upgrading our lower level or the craftsmen level just above the craftsmen. We understand now that technicians is a fairly big range slightly above crafsmen and just below a professional engineer. And to be able to cater for all these categories of technicians is rather an expensive affair. It is very difficult for a country like Fiji. The first time we heard of the Staff College was when we read about it in one of the papers sent for this conference. I just wondered if the Staff College could concentrate more into the smaller countries who cannot really afford sophisticated polytechnics and who cannot really afford to duplicate within the region like we have in Papua New Guinea. We have facilities in certain disciplines but there are other smaller countries within the region who cannot really afford to put up their own facilities. Of course there is a move within the South Pacific to try and use what facilities there are in different countries. Since these different countries are administered by different bigger countries, small countries want to have their own facilities. This means duplicating facilities which could be concentrated in one particular area. I just wondered if the Staff College could spend more time into the smaller countries who are really developing in this because as my colleague from Papua New Guinea said yesterday, technician training or for that matter technical education is very new in our region. Even in the schools we are trying to introduce technical or practical subjects like metal-work, woodwork, home economics for the girls and it will take a long time for everybody to be able to do this practical subjects. In the meantime, we have got to do something with the people who are coming out, something with our own training of technicians. Fiji is not that sophisticated, we do not manufacture any machinery. We concentrate on maintenance. All our training are based on technician on maintenance and probably on installation of instruments in telecommunications. I wondered if the Colombo Plan could give more assistance in the form of scholarships than at present to get a first-class diploma. We think that we do not really need as many engineers. We sent our students to very well established technical colleges overseas. We have not got the facilities, we have not got the staff to train this particular cadre of technicians and this is where I think member countries, places like Singapore, who are fairly well developed in this line could help. Of course, as a member of the Colombo Plan we can use some of the facilities which are nearby. We also send our students to New Zealand, to Australia but sending our students to places like Singapore or Malaysia and other places where they are well versed with the training of technicians will, I am sure, help the region. And if you help Fiji, it will in its turn try to help its neighbouring smaller countries to develop their technician training.

CHAIRMAN: I might add perhaps forestalling any comments Mr. Koh might make on the question that has been raised by the delegation from Fiji that Singapore has recently offered about 1,000 places to member countries in the region for training purposes and it is up to the Fiji Government to apply and that goes for any other member countries in the region. If there is a need there these are available under the normal bilateral procedures under the Colombo Plan. In certain circumstances member countries will increase their allocation of training places to meet those needs. This is not unknown in the Colombo Plan context and your comments followed quite closely to those made by Mr. Paskaralingam about intra-regional training.

PARVEZ: In this particular question I do not see any clash of interest between intra-regional training and the development of what I call an indigenous system of technician education and development of indigenous technology. There has been a temptation in developing countries to overemphasise the transfer of technology, undue emphasis, excessive emphasis. I think this has done more harm than good. To take two concrete examples, one relating to technician education and the other relating to industry. For instance, in certain countries, my country included, we have transplanted some sophisticated technologies in our technician education system. I think the industrial market was not ready for them, industry was not there to absorb the product and hence we produced an over supply and hence a lot of frustration. Second, in the teaching process itself, for instance, in automobile to take an example we have a lot of sophisticated equipment, trouble shooting, electronic this, electronic that. Now this boy when he passed out he went to the market, there was no such machine available in the market and there he was left high and dry. To take a second case, in the developed country the cost of the human labour is so high that they prefer to change a certain component which is defective rather than trying to repair it. But in developing countries you know where you have to import everything and the foreign exchange reserves are always limited, it is always better to repair a thing as long as it can last. So I think we must try to emphasise the development of indigenous systems. The Colombo Plan Staff College, the Colombo Plan Bureau and such conference can help us really in learning from each other. Second point is about industry. One reason according to me and I may be mistaken, why technicians have not been accepted in the developing countries is that there is no research and development activities in industries in developing countries. We take a certain factory, we bring it, we transplant it and we train our people to work there and thats all. Because of the lack of research and development activity industry does not really need technicians. When we go to the industry they say, well you know this skilled worker that I have is the best man to do it, whereas if a technician is there he would demand more pay, he would demand better working conditions and he would also like to change something, to innovate with the help of the engineer. So I believe that even in the development of industry it is necessary and also in the acceptance of the technician that we should give proper priority to the development of indigenous technology and that can only come about with the help of the technologically trained engineer and what is more his most important co-worker, the technician.

KOH: When the discussion began I was rather concerned about the emphasis on the Staff College. Now we have got our political colonialism, we are suffering from economic colonialism and I hate to see the Staff College emerging as a colonial power determining the technical education directions that we all take. I think we should concentrate on the system of how to develop an indigenous system of technician training. The inputs people have talked about, technical assistance programme, scholarships, fellowships and so forth. One of the most important considerations is how much money needed to keep a system going. Technical assistance in terms of equipment, in terms of experts, come quite easily or rather relatively easily compared to a country's ability to maintain that system. We could get a grant of 400,000 U.S. dollars worth of equipment and it comes down with one big milwakee shaping machine worth 150,000 dollars. Well when that machine breaks down, a replacement is 5,000 U.S. dollars, one piece of little shaft and you are stuck there, the machine is gone. This is one of the dangers of taking technical assistance without looking into your own ability to carry forward the programme. And again I think Mr. Parvez raised this question about equipment used, somebody being caught on very sophisticated equipment and finding that in his background this equipment is not available. As the Chairman has pointed out, we have offered a thousand places for training in Singapore. One of the things that concern us about the people, the trainees, who come into Singapore is that a very few of them really knew what they wanted. They come and say what is the programme you have got to offer. Quite distinct from this is the reverse situation that we have found that up to 40 percent of the fellows Singapore sends abroad for training in foreign countries re-write their programme when they arrive there. Because before they go out we brief and say look you are going overseas, you are going to get training in this. Now we do not know what they are offering you but you look for this and you force your way into this and this sort of experience. This is a sort of knowledge, this is a sort of skill that we want you to get and you go there and if necessary ask them to re-write the programme for you and we have managed to succeed and in some cases we have got our scholars returning three months after they set out because they say this country cannot meet my requirement and so this is one of the things. In our case we try to readjust; we had some Cambodian students who came during the middle of last year and aside from the initial language problem they were more conversant in French than English so we put them through an English language training programme. Beyond that we had to have long sessions with them and ask them what they wanted, what they were going to do when you go back, do you have a college to teach, what is there in this college. As a result of all this discussion we change so they are in fact working in Singapore on a programme which is completely unique to an individual. So when he goes back at least he would be able to use the experience we give him. We do not put him to our regular programmes because our training programmes are meant for our own needs and he is going back to serve his needs which are comparatively different. We have avoided teaching him using very sophisticated equipment. As for example, in automobile repairing we have avoided using this very modern methods of wheel alignment. Instead we have gone on to the basic wheel alignment system which we think we can develop without purchasing equipment. So this is the short of thing that we want to develop within our countries. With regard to relationship between technical colleges and industries, in Singapore we have managed to get this relationship with not only the local industry but also with foreign industries. In today's paper there is an advertisement for skilled craftsmen to undergo attachment in foreign factories. This is in Germany and Switzerland for advanced training in fine machine mechanics. Now this is a sort of thing we finance the trip and these people do not come necessarily from within the public sector, they are from private industries. So any firm can ask for advanced training for its machinist. He applies to the government, we sponsor his trip overseas. This is the sort of indigenous system that we create for our own situation. There are different levels of development, different levels of being able to sustain a programme. I think it is very sad that in many and in some places a technical assistance programme comes in it is implemented for three years and within three months of the end of that programme the whole thing fizzles out. So lets look at that. With regard to the role of the Staff College in Intra-Regional Training, I would ask for a more flexible approach that the Staff College does not set itself up as an imperial power which determines what people shall take but that it shall be a flexible organisation which will change, adapt and modify its programme to meet the requirements. While there is advantage in getting together a group of people from different countries to discuss a so-called common based programme, I would like to see the Staff College play a more specific role in relation to the specific needs of different countries. I think Fiji made a very strong plea for that and I would support that sort of assistance or advice I would not even presume to call it advice, could we say discussions and suggestions for people for lines of action. Now whether the transfer of technology, and whether a commonality of operations by the Staff College would impede transfer of technology. Now this assumes that we want transfer of technologies. Now while certain forms of technologies are desirable for transfers but there are many forms of technology which I think more undesirable for transference in view of the state of development of the particular country. I refer particularly to the introduction of a very highly sophisticated instruments and equipments. A very simple example, this came up in one of the Unesco conferences where everybody said teaching can be made more effective by the use of audio-visual aid. So there was a large import of overhead projectors into a country in Northern Africa and this was kerosene operated so there was no problem of the power source. But few people realised that the sand storms can have a very abrasive effect on the lenses and the result was that after one sand storm the whole thing is gone. That is a transfer of technology for you. Somebody has to teach him that he has got to protect the lenses, to protect all its parts from intrusion by sand, very elementary but that is the problem of transfer of technology.

SRINIVASAN: The issue that we are considering is obviously what is the contribution of technician training in the process of the transfer of technology. I do not think we should presume that all transfer of technologies is possibly only through this agency of technician training alone. There are many other facets to this. We should mix up the two issues of intra-regional facilities and the role of the Staff College. Of course I can anticipate that perhaps a stage will come when the Staff College could perhaps completely supplant the other activities and take over all the responsibilities of the intra-regional training programme. But I think it is too much to expect at this stage to burden the Staff College with all the things we could think of on intra-regional facilities. So we should keep these two difiifferently, one is intra-regional facilities and the other is the role of the Staff College. As far as the intra-regional facilities is concerned I for one feel that there is no limit for intra-regional co-operation.

I mean anything could be thought of, for example, perhaps Japan and India are particularly acquainted with this. There is the international association for the exchange of students of technical experience (IAESTE) where vocational training is provided for, in industries of various countries to students from other countries. Of course it is mostly operating in West European countries and in the United States. I think most of the countries in this region have been sending a few students but our experience has been though it has been vocational training these students who go for ostensibly three to four months training programme after some time manage to get some sort of apprenticeship for longer periods and stay on there, either for further training or for studies there defeating entirely the purpose of being sent there. I was just thinking of some sort of regional programme on this basis between industries and other institutions in various member countries where training could be arranged because you find different levels of training available in the region itself. As far as the Staff College is concerned, Dr. Chandrakant pointed out many areas of technician education and training where what could be done as matters of manpower assessment, training and relationship is one area and the second is, perhaps, development of physical facilities. And third, most important, is perhaps the end-product. These are matters of general interest to all the member countries as our friend from Bangladesh pointed out. What is necessary is that we should identify the basic minimum needs and should try to see how far the Staff College could try to train people. I see the role of the Staff College as the trainer of trainers so the Staff College could try to train people in the tools of these various areas of worthwhile technician education. This question of transfer of technology is the first question that arises from the Vice-Chancellor's Paper are unconnected with other questions in the pamphlet given to us. Naturally, I will point out two things which have repeatedly been stressed, one is about the status of technicians. Somehow in this I find a sort of orthodoxy. I do not see why we should hold the brief for a technician. We are interested in upgrading technician courses, we are interested in a sort of improving the standard of technician courses and the standard of diploma courses but we are not interested in technicians as such. If the technician is not wanted by industry and other employing agencies, if the technician cannot stand on his own let him go. We are not here just to perpetuate the system of technician education just for its own sake or technician as somebody said, technicians know how to do it and also why. But how much of how and how much of why depends upon various circumstances and the status naturally is gained by various things, social, economic and so many things. I do not think we should form an association, trade unions of technicians and try to build up his status. We just want to see what the employing agencies want and we try to give them and how best we do it. I think we thought of industrial collaboration. Here again there is much of misgiving as to what the industry wants and what the industry does not want. I have a feeling that industry itself does not know what it wants. Therefore, there is no use in blaming the industry because we are two wings of one system. If you just look at industry as something separate industry also is suspicious of us. Many a time this suspicion is borne out not only by a sort of ignorance but also out of superiority complex and inferiority complex. I think just having industrialists on the role will not help for the reason that even though we certainly want people at the higher level, the general manager, the managing directors and others for policy-making, but what we really require as far as fashioning of the courses, curriculum development, is concerned we require people like the shop-floor level. Therefore, I think we should have the blessings of the top people but at the same time try to get involved people at the lower level also and then go about it. It is not merely sort of exchange of views or change of hearts but it is a question of enjoying the confidence of each field.

CHANDRAKANT:—All the points made by the participants go to emphasise what I always held strongly that each country must make its own efforts to develop the system of technician education that is most suitable to it. But in this process it is possible to identify across all these countries the common areas which are of concern to all the countries concerned. It is in these common areas that the Staff College could play a role in equipping the persons concerned with the knowledge, with the skills, with the competences, the need to deal with their own systems. I see the role of the Staff College particularly in that light not to supplant national effort but to back up the national effort by training those persons who are responsible for developing their appropriate systems of technician education and training suited to their own needs. At the same time there are smaller countries I do recognise which have their own special problems and here too the Staff College can play a role in helping those individual countries to deal with their own specific problems. That means the role of the Staff College to summarise will be a two-fold one, that is, to identify the common areas of concern to all the countries and mount programmes appropriate to those countries. Second, to identify the special problems of smaller countries and help them in developing their own systems of technician education and training. I do not visualise that the Staff College can supplant the intra-regional co-operation that exist today that needs to be promoted further. Let us see that the Staff College role is not mixed up with an established activity that is doing a lot of good to the countries in the region.

AINUDDIN:— This question came out of my paper, when I say the indigenous system of technician education as already mentioned the first thing is we should relate it to the existing system of education in the country. Some country may say, yes, your secondary education may be different from another country's secondary education may be 10 years, may be 11 years, may be 12 years, this varies. So this is the first thing. Then the level of the existing development, the stage of development of a country, this should play an important role in which direction you are going. You may be emphasising on agricultural development then you need a different category of technician you may be going for indentical development then you need a different type, and all this must relate to one another. Then coming to the role of this Staff College and intra-regional training I think the first thing that the Staff College can do is to provide training facilities for technician teachers of those countries where there is hardly any facility for the training of technician teachers. I think that would be basic indeed. Of course then they can have a higher level of training for the existing teachers in the various countries then there may be some common needs and this could be organised by the Staff College. And the Staff College can also play an important role in the dissemination of information on technician training. Just now I think the delegate from Fiji mentioned about telecommunication training in his country. Well this afternoon if you are going to the telecommunication centre, I am sure you can find out from there that there are places for other countries to send their candidates to this institution. The other point about transfer of technology, I think what we should do is, we should not talk about transfer of technology but we should talk about adapting technology. This is very important. In this country we have a lot of tapioca or cassava as it is known to some people. At one stage one factory imported a plant from overseas which was supposed to do work but it failed and fortunately one of our mechanical engineers devised another type of machine and that is doing the work beautifully. This is the thing where adaptation of technology is more important to us in the developing countries rather than transfer of technology as such.

CHAIRMAN: There is one comment that I would like to make, perhaps to reassure Mr. Koh is that the Consultative Committee rather anticipated the reservations that he had expressed about the motive of the Staff College taking upon itself the role of some supra-national institution and dictating the terms of technician education within the region. We feel that the Consultative Committee's wisdom in expressing a preference that the Director of the Staff College be from within the region itself was sufficient guarantee that might assuage any mental reservations he has about its future role. I pointed out in that it has only been going in nautical terms half a dog watch and has had no opportunity yet to develop that kind of ambition and I do not think it is likely to. With those comments I think we will pass on to the next question and address ourselves to this one.

Q. 2. **"Should developing countries undertake crash programmes to meet their immediate needs of technicians? If so, how can this be done without too adverse an effect on standards?**

CHAIRMAN: Now I would enjoin you to keep your remarks to the point and I think we may be able to dispose of this particular one fairly quickly.

SEN: This is a very important question for Bangladesh. I think the developing countries should undertake the crash programmes. In Bangladesh we require immediately a lot of people to work as power pump operators, diesel mechanics to materialise our green revolution. We cannot wait two to three years so that the technicians could be trained in power engineering. We require them immediately so we are starting three to six months training for diesel mechanics, power pump operators so that they are useful for our agricultural work. So this is needed, probably according to the need of the country they should be undertaken. And I think if this crash programme is introduced in a particular country this will have no adverse effect in the standard because this is a separate programme for a particular need. Our regular programme is always there. So when I say the standard, I mean the standard we have in our technical training centre or the polytechnic institutes. That would be followed according to the need of the individual country.

SUBRAMANIAM: I feel that crash programmes would only produce half baked technicians who in the long run would prove to be a liability. In our country what we are doing is that when we are short of technical instructors we get them on a loan for two or three years from U.K. or from other countries and these people in turn train our local people and once these people are trained the trainers go back to their own country. Well in the context of Bangladesh perhaps crash programmes are an immediate necessity because they cannot wait for two or three years. But if at all you can wait it will be better to wait and train your own people to the fullest extent possible which in the long run would prove beneficial.

CHAIRMAN: Mr. Subramaniam, I would like to ask you one question. I think that in Fiji's case the scale of a problem is not as large perhaps as it may be in other countries and assistance from outside may be available to Fiji in the quantity that is required. The needs of countries like Bangladesh and others within the region may be so large that this kind of prescription will not represent any sort of viable solution. Would any other delegation like to comment?

ASISTIN: Well I think our answer to this question should be yes. The Philippines experience is simply like this. There was a need for such a training programme because of the inflow of a number of multinational investment activities. For instance Japanese nationals came in with the Toyota assembly plants, Ford came in with the manufacture of engine blocks, and other multinationals came in and so there was a need really for increasing the tempo of technician training. So what we did was to put up a crash training programme under the aegis of the so-called National Manpower and Youth Council. This we did in the beginning for a period of six months and thereafter we phased out this programme after one year and now we have this so-called expanded training programmes which lasts for about one year to 18 months for technician training. In addition to this we also had this so-called training programme for technician teacher training as a corollary to the crash training programme for technicians. So the point here is if there is really a need, yes, we should do it. But we should also in addition take care of the long range need while undertaking crash training programmes.

GARUDACHAR: Mostly in any crash programme the stress is on quantity, as a result quality suffers. Therefore, I personally feel we should pay more attention to quality than quantity. Another thing is that the duration of training should not be short. In many cases what we do is we restrict the period of training as a result we pump in quite a bit of information in such a small period which as a result the boy cannot take and the crash programme crashes.

SARUVA: I think crash programmes where necessary can be undertaken effectively especially if you want to cater to the immediate needs but having gone through the crash programme it should not be the end. This should be followed by in-service training for those who undergo crash programmes. This ensures the participants or the trainees who are undergoing the crash programmes to better their knowledge and training. Taking a classic example, Air New Guinea that is the National Airline which took over from two Australian Airlines, Trans Australian Airlines and ANSETT ANA, the Education Department was told that we want aircraft maintenance engineers. We asked for money, facilities and personnel but were told that we do not care how you go about it but what we are interested is getting our engineers for the aircrafts. So with the limited resources we have, we are trying to train about 8 or 10 persons in one of our technical colleges. The results are yet to be seen but this would be followed by intensive in-service programmes. I believe there was a country in Africa where there was a huge exodus of overseas experts after independence and there was a great need for about 2,000 primary teachers. The fellow in charge said that we are going to have 2,000 primary teachers and they did get 2,000 primary teachers in one week. I would not like to go into the effectiveness or the qualities of this but it shows it can be done.

CHAIRMAN: Perhaps a suggestion about the incentive to high service ability rate in your aircraft might be to insist that your aircraft engineers when they have done their job take a ride in the aircraft. I found from practical experience that it was a very good method of approach.

SEN: My friend from India is not supporting the crash programmes. I want a solution from him how we can meet a shortage of about 6,000 power pump operators and diesel mechanics within a very limited time, within six months. We cannot wait. These people should go from village to village, start irrigation work and help grow more food. You know there is an acute shortage of food which we have to meet and therefore our President Sheikh Mujibur Rahman has launched this green revolution. We have to materialise this any way. So this will be the other class of people. Besides there will be some trained people, polytechnic graduates. We are training them for 18 months at the technical training centre and specialising in diesel pumps maintenance and other accessories who will guide these technicians on the field. They will move from station to station and if there is any difficulty for any operation or maintenance they will give their guidance and that is what we are doing now.

KIM: The delegate from the Philippines said that the answer to question 2 is yes. But I think the answer should be inevitable rather than yes. Well in Korea the supply of technicians has three sources. First, the degrading the graduates from colleges who are supposed to be engineers, secondly, the graduate from junior technical colleges and thirdly, upgrading the craftsmen. Now in our country we need a large number of technicians because the government has laid a big emphasis on the development of heavy chemical industry. Now to supply that great number of technicians we operated double shift and also established night courses. So the matter is not yes or no; the problem rather is a matter of priority on quantity or on quality. Even when we produce technicians in such numbers, there should not be any adverse effects on standards. We have a developed kind of programme and instruction systems for technician education called individual assessed technical training programmes. So what I mean is that we have to have a crash programme to meet the immediate needs of technicians. But it does not necessarily bring about such adverse effect on standards. Because as one delegate suggested that kind of crash programme should be followed by in-service training programme and other devices of new educational technology.

PASKARALINGAM: I would rather answer the second part of the question, "If so, how can this be done without too adverse an effect on standards" because I think it would be presumptuous for us to prescribe whether the developing countries should or should not undertake it. It all depends on the peculiar needs and the problems in each country. But if the necessity arises to have crash programmes, judging by the experience of my own country, I would suggest that the intake of the students for this crash programme should be students who have had at least a high basic knowledge of the pure sciences. If that is done the technology part of it and the in-plant training, of course they would always be on the job, could be given at least one or two evenings or by block-releases or day-releases. But in any case the danger I see in encouraging crash programmes is we as educators would be the loses in the long run because crash programmes by their very nature would be controlled and undertaken by the industries, by the corporations, or by the developing authorities. So this would encourage the various developing authorities other than the educators, I mean the institutions, to think more and more that they can do it always and we the educators would be the loses if we allow this to be encouraged.

CHAIRMAN: There is also the question of the results of these crash programmes, the people who are trained under them encounter resistance from people who have already entered the trade or profession or area of technical activity. This was the result of the "pressure cooker" courses, as they were so-called in New Zealand, of teacher training. They accepted people in the sciences at a fairly advanced stage, either they passed their degrees or approaching their completion. But even then the normal period of teacher training was cut for the benefit of these people and also to fulfil the need but the resistance that was encountered from the teaching profession itself to the products of these courses was quite substantial. You get that in the field of labour relations and in industry too where they regard these fellows as being half baked.

ANANTA: I agree with the crash programme if we have immediate needs. Well, we have such a programme in our country too but it is rather different from some that has been mentioned. About 10 years ago, we had a very urgent need for technicians in the field of telecommunication. So we set up a short course for six months to train the students not for certificate or a degree at all but for training them for use in the telephone organisation. We followed this up with the in-service training for several years and it is very successful in that field. That type of crash programme has now been developed to be the long term programme and now it has been adapted by the Institute of Technology in the electronic field and we have quite a number of specialists from Japan to help us with all the institute equipment. It is becoming one of the best in electronic fields in the country. So I would conclude that I quite agree with the crash programme that should have been set up for the developing countries. This programme should be followed up later on as has been done in this field and we think that the other field should be done in the future too.

CHAIRMAN: Would you mind winding up this discussion on this question please, Mr. Ainuddin?

AINUDDIN: When I presented my paper I said we should first attend to the immediate needs. A crash programme should be specially designed to meet the immediate needs and implemented quickly. Now if we want to get along we got to do that. A good example, these may be an extreme example, in one country in Africa there was a higher rate of gonorrhoea in the population. There were very few para medics, so they trained special group of people with a basic education upto secondary school. Less than half the normal period required to train a para medic, to just identify that particular germ or whatever you may call it, taking the smears identifying that and if that is positive then they give the jab and that solved the particular problem of that country immediately. If you had to wait, you may have to train para medics for two or three years then by that time may be the whole country would be effected. How can it be done without lowering the standard? First, by way of over specialisation as I said just now, then the training normally could be split into various parts, we do just half of it if the need is so urgent or three quarter of it within a shorter period. It may be that there is no vocation for the student for that particular group or may be for the two or three succeeding groups, then after they have gone to the field and the next batch comes out, the first batch will be taken in for further upgrading; this can be done, can be worked out. There was also a suggestion just now that we can take foreign technicians in and have understudies but this is too expensive a way and it is only suitable for small projects, yes, but not for a scale as mentioned by our delegate from Bangladesh. About half-baked technicians as just now mentioned, may be half a loaf is better than no bread at all. We are struggling, we are trying to survive, we are not flourishing yet. So half-baked technician is better than no technician at all. The delegate from India mentioned that the crash programme will crash. Well it is a crash programme but it is to avoid a crash. It was mentioned that it emphasised quantity not quality. Now for that particular time that quality is sufficient to meet the need and this is an economical situation but if we leave it as such then that opportunity is lost and the effect on the society may be devastating. Mr. Chairman, you mentioned about resistance from those already there. Well, of course, there would be resistance but, if the people in that group thinks about the national requirement then this resistance should not be there. We must not think of any situation completely from the materialistic point of view. We must be more than just that and i[illegible]hat is attained then half of our problem is solved.

CHAIRMAN: Can we get on to the next question?

Q. 3. "How can the education and training of technicians be geared to have the greatest impact on the economic development of a developing country?

CHAIRMAN: I feel that the phase "to have the greatest impact on the economic development of a developing country" is a bit perhaps misleading. I think "to increase the impact on the economic development of a developing country" would perhaps be better because the training of technicians no matter how well or ill they are trained does have some impact on that and what we are aiming to do is to increase the effectiveness of that impact and to sort of reinforce its whole cumulative effect. I mean greatest impact really relates, it is quite subjective, and in economic terms it is indefinable, so I feel that we approach it from that angle. It might make it perhaps easier to deal with and contain it within a framework which we can dispose of within the next few minutes. So would anybody care to comment on that?

PALA: I see some similarity in this point when we discussed "how can we increase the impact". The training should be constantly kept in touch with the needs of the industry. Some kind of surveys should be carried out on a continuous basis not only on the needs of industry, the type and level of manpower, but also what is the level of the students when entering the training programme and what is their ability to learn. I would suggest a kind of continuous contact with industry to improve and increase the impact of the training on the economic development of a country.

PARVEZ: I think in talking of technicians industry has become a fixation. Let us try to transcend that because technicians are needed not only in industry, we need technicians in business, in banking, commerce, agriculture, all the fields of human endeavour. That is another limiting factor. Actually, I always revert to the status of technicians with which Mr. Srinivasan has taken issue. The point is that if you fertilise this breed and you propogate it I think we need this middle-level manpower everywhere but our polytechnics, our technician education systems, are very largely geared to producing technicians for industry. I think for an overall economic development it is necessary that we in the developing countries must widen our horizon and try to locate middle-level occupations in other fields and design our programmes accordingly.

WAHYUDI: In order to answer the third question, all countries in the Colombo Plan region should have a national advisory committee on technical education. Members of the national advisory committee should come from industrial community, from government offices and experts in allied fields in order to find out the needs for manpower and in outlining the directions to national development plans. So to develop the planning of technical education the first step is we make local advisory committees and if possible establish regional technical planning colleges.

LA SERRA: In our programmes we have always underlined the fact that a supervisor has the task to train his own people. I think that we can consider that a technician must be prepared during his own training to transmit his knowledge to the people with whom he is working. This will have some effect on what is asked in the third question. But in the programme of training technicians we have to prepare them to transmit their knowledge to the people with whom they are working. We can get all the results, like for instance, his status because he will assume the position of a teacher that is always respected and recognised by people who is not only receiving orders from him but also knowledge. The second point is that he will be able to assist the institutions or the factories or the enterprise where he is working to select and upgrade the workers working there. So he will constitute the factor of progress inside the community where he is working. The third result we can get from this particular component of his training would be to multiply the effect of what he is knowing and what he is doing in co-operation with the people with whom he is working.

CHAIRMAN: There is one aspect of the question that I think perhaps we might consider before we ask Mr. Ainuddin to wind up the discussion and that is the larger aspect of it in the planning context. Now economic goals change from time to time as a result of changing circumstances and I feel that the question has been partially alluded to about the consultation with industry as Mr. Parvez has commented. I feel that there is more truth in that and that the whole conspectus of the thing might be looked at from the planning stage. Most countries within the region have got some either planning or indicative planning so that they can relate their needs and, perhaps, change the actual content of technician education programmes and the fields in which these technicians are being trained and the quantity. This is something that this meeting might consider and offer some guidance to member governments on how to proceed so that to reduce the kind of wastage and structural rigidities that introduce themselves into these programmes from the side of demand and the side of supply. Now I feel that this really is more the nub of the problem than the sort of detail of the actual conduct of training programmes. I would like delegates to comment on that aspect of it if they feel so inclined.

PALA: I am very much in favour of what you say. Indonesia has a five year development programme, a National Development Programme, in which all the needs of the country are spelt out and we base our programme on these national development programme in which priorities are mentioned. I think also the technician training should on a regional basis take all these national programmes into consideration.

CHAIRMAN: Perhaps there should be some regard to the anticipatory element in the development of new resources as Mr. Ainuddin referred to in the context of the petroleum exploration. I think that this kind of thing this Colloquium should take some note of it.

PASKARALINGAM: This is rather a very broad question and I think to my knowledge most of the questions which follow also will have a definite bearing on this bigger question. But I think in one area where we in our country have been attempting for several years to bring about but have still not succeeded is to have a national committee for a national commission for technician training with representation from the planning ministry and the various other ministries. Unless there is a body at the apex which is recognising the technician training separately and which can co-ordinate the technician training undertaken by the several agencies it will be very difficult for us to make an impact on the economic development. We have felt this. I suppose in U.K. recently they have established a Council for Technician Education and Training. I do not know of any other country which has a National Council for Technician Education and Training. But I think it will be very helpful in making an impact on economic development.

MUHIUDDIN: I was thinking Mr. Chairman, that technical education or technician education should not be rigid as you yourself mentioned and Mr. Parvez also mentioned. It should respond to the growing requirements of the economy. We should know what our requirements are and then the planners should tell this is what we need for the five year period or the ten year period and then the institutions should go and develop courses to meet the requirements of the economy as a whole, not multi-sector requirements and also not just one sector.

CHAIRMAN: Dr. Skelton would you mind commenting on Mr. Paskaralingam's observation as they are related to the United Kingdom?

SKELTON: Mr. Chairman, it is true of course that we have set up a Technical Education Council recently. It is very early to say what effect this will have. Of course the system was and is a very complicated one in the United Kingdom with the City and Guilds which I think everyone knows and the National Certificate courses of the Royal Society of Arts. The main objective in setting up this Technical Education Council was to try to streamline this a little and to bring in common standards where we shall be awarding Certificates and Diplomas at the end of this which will correspond very roughly with the old National Certificate and Diplomas. But I am not sure really how this applies to perhaps the more simple system of the region. As I say the main object of trying to get a very complicated system down to a simpler system is obviously highly desirable. This may not be directly applicable at the moment to systems within the region.

CHAIRMAN: But would you see any virtue in recommending some form of trades certificates within the region even at that level?

SKELTON: I would certainly, yes.

CHAIRMAN: I think perhaps delegations may wish to comment on that kind of thing. I feel that the meeting might say something about the publicity or the information that is disseminated to the general public and perhaps in industry about the courses themselves and the course content. If this would make some contribution if it were done by some National Planning Council as it is in Sri Lanka that there may be some possibility of its adoption in other countries throughout the region in line with their own needs. Would anybody care to comment further on this?

SRINIVASAN: I would just like to mention the situation in India. We have at least in India education as a State subject but in the Federal Union set up we have an advisory body called Indian Council for Technical Education. A few years ago this All-India Council for Technical Education did set up a high powered committee for the reorganisation of polytechnic education. Arising out of the recommendation of this Committee a Board of Technician Education has been formed as one of the Agencies of the All-India Council for Technician Education and this Board consists of various representatives of professional agencies who are interested in the co-ordinated development at this level. We also have at the State level, the State are responsible for technician education programme, the State Board of Technical Education having accrediting powers for all these courses. In addition to this, an industrial liaison board has recently been set up at the State level which consists of normally the Ministers of Education and in many cases Ministers of Industries also. All these efforts naturally take into account general co-ordinated development and planning in the States and in the whole country. Obviously, it will have an impact on the economic development from the technician education point of view.

MURUGASU: Mr. Chairman, just a small observation. I am happy that the question incorporates education as well as training and I think there is a tendency for most of us to ignore the first part, the importance of education in our training programmes. I think the best possible way, at least one way, of looking at the answer for this question may be by looking at the functions of the technician himself. As I see it from the discussion there is a link between the two levels at the top as well as at the bottom. The range of his responsibilities and the range of understanding would probably be very large. He has to be a man capable of cognitive as well as manipulative work as Mr. Parvez put it. He has to play the role of a communicator between the two extremes, he has to be an innovator, he has to be a leader. If he is going to play an effective part in his roles, which are manifold, and to have an impact at all on the economic development of any country then he has to be properly trained. One of the serious drawbacks of a technician, is this question of communication problem a technician has in communicating his ideas both in writing, orally and also graphically. Unless a man is able to communicate his ideas and put across his ideas suitably in a manner and understanding both at the lower level where he has to adopt earlier methods to a more intellectual approach when he is dealing with the engineer at the higher level then all the efforts for which he has been trained would probably be wasted. I want to emphasise that more importance and greater attention should be given to this communication and articulation aspect of the technician. And also to be more effective every technician should have, what we called when we discussed in Singapore, the multiplier effect. This is because not all technicians are going to work in industries and factories and act as a link and even if he does so perhaps he could also resort to adaptation, as Mr. Ainuddin put it, adaptation of technology. He should be able to make simple adjustments to needs in industrial machinery so that he could cope with local requirements and perhaps and on to further development areas. Those who are not employed in industries themselves, who are self-employed, should be able to generate further advancement in simple forms of technology. So to summarise, this innovative and creative approach that we would expect from a techincian seeking, inquiring and leading is a very important aspect if the technician is to play any effective role and have consequently any impact at all on any economic development of a developing country.

CHANDRAKANT: The question implies that there cannot be only one level of technician education and training programmes for any country. It has to be a multi-level one and as Mr. Parvez said our over-concern with industry has made the technician education system a little too rigid which is not responsive to the other sectors of the economy. If one were to examine the different sectors of the economy of a country, primary, secondary, tertiary sectors, the technician education system is addressed primarily to the secondary sector and also to a narrow part of the secondary sector. The primary sector is more or less completely left out, that is agricultural sector and the inter-phase of agriculture in industry. If you go to the tertiary sector, the services sector, a large proportion of that sector has been neglected so far as the technician education system is concerned. So to my mind if technician education has to have the maximum impact on the economic development of a country, it has to respond to the whole spectrum of economic development right from the beginning of the primary sector to the end of the tertiary sector.

CHAIRMAN: I call upon Mr. Ainuddin to wind up the discussion.

AINUDDIN: The question is "How can the education and training of technicians be geared to increase the impact on the economic development of a developing country"? Well I think the short answer to that is that education and training of technicians should be relevant to the economic development of the developing countries requirements. Having established this relevance, we should go as for minimal standards. Then you get the men you require at the shortest time possible with the smallest expenditure. The general education of a country should be so geared that there is more emphasis on mathematics and science. There was also mention of problems of co-ordinating existing training facilities. The delegate from Sri Lanka mentioned about training by the various technical departments. This should not really interfere with the general education of the technicians in the sense that these departments play the specialised roles unless they go to the basic training of technicians, as you would see it when you visit the Telecommunication Training Centre. They do take graduates from my place at the diploma level yet then have to be trained for three months to six months in this telecommunication training centre to adapt them to the particular need of that particular department. Various other government departments also do that. And then I think in the programme of technician education we must also bring in this element of regard of human values and leadership. Here I do not know in other countries, but here at times we get these people coming from the technical training institutes or from the technical colleges, thinking that they are of that higher calibre than the masses on the ground. And if you cannot really appreciate their thinking their attitude, then the project of training of technicians will be a failure. The delegate from Sri Lanka also mentioned about the problem of dealing with these various institutions or various departments having training programmes. It seems to me a political problem. This has also been mentioned by Mr. Parvez, earlier when he mentioned about various technician training institutes wanting to be colleges and subsequent demands made of politicians and politicians suggesting that this should be done. Well this is our own problem for which there is no general solution except that politicians have to respect what is true rather than just cater to mass popular demand which may in fact effect the country adversely. I completely agree with what was said by Dr. Chandrakant about having the whole spectrum examined and technician education and training should be geared to the economic development plan for the particular country.

Q. 4. **"How can the status of the technician be improved in the countries of the region"?**

Q. 5. **"How can technician education and training be so organised that higher education, career advancement and promotion prospects are ensured to technicians"?**

CHAIRMAN: About the next two questions, I think we could dispose of the first one fairly summarily and concentrate on Questions 5 and 6. I had thought of trying to telescope 4 and 5 together but I think they are sufficiently different from one another to warrant separate discussion. Perhaps, in view of Mr. Srinivasan's observation on the status of technicians he would care to lead off the discussion. Mr. Srinivasan have you anything further to add?

SRINIVASAN: I give the impression that the discussion is being monopolised, so I would suggest some other colleague to start the discussion.

CONNELLY: May I reply to Mr. Srinivasan's challenge. He said that all you need to do was to ask industry how many people they want and then you provide courses to suit their requirements. He has not said how you get the people to take the courses. It is very important that you do have people attend these courses and how do you get them? First of all you make the salaries of technicians attractive. I have been in contact as an outsider with the Colombo Plan region since 1963. It has been my observation that there is surplus of engineers and an adequate number of craftsmen and a very great dearth of people who can operate and maintain, in other words the technician, the man who can take on middle management. The reason for that is that there is this great lure of the degree and yet we have got engineers who are unemployed, engineers who are underemployed and people who are in administrative jobs who have not done engineering yet have an engineering degree. It is obvious that it is necessary to improve the status of the technician in order to attract people into that category. First of all we have to recognise that there is such a category. Industry and the government have to recognise this and then of course it is up to the individual technician to show that there are men who can actually fulfil the role of a technician and that they can do it well. Once you have enough of them who are in this category then they form their own association if you like and set their own standards for admission into the role of technician. Mr. Parvez introduced a number of questions on page 31 of his paper which might give some thought for those who might like to discuss the subject.

SRINIVASAN: I did not say that the standard of the technician should not be increased but I was thinking aloud whether we should talk so much about the status of the technician. The point is when we think of the technician we think of what makes a technician. All relevant factors such as educational background and duration have to be taken into account before we think in terms of improving the status. So I think what we really feel is if the technician has to be on his own, first he should think in terms of his adaptability to the situation where he is, his standing on his own and his being able to make contribution not only to himself but also to the organisation he is working for. This is what our friend from Singapore said earlier. I think it is not so much as what industry or any other ogranisation does for him is not that important as what he does for the organisation. Because we cannot expect that these organisations are there for the purpose of feeding the technician or improving his situation, he is there to improve the situation of the industrial employing agencies. As long as he can contribute something, as long as he can feel that he is one with them, he is doing something, he can get the maximum out of it. As far as this complex of his not being able to sufficiently take part either in the technical format of the whole unit or whether in the social context his education and training should be such that he comes out of it. But again it depends on the general education background which he has got. Therefore, I am not saying that we should not provide opportunities for improving the technician skill but because we do recognise that many of the people who go for technician education do not go possibly because of their own choice but because of many other socio-economic compulsions such as not being able to go on for longer duration courses of getting admission in higher institutions. We should take all these factors into consideration and make good for these deficiencies at a later stage. But once we do that we should also recognise that the chances of his remaining a technician are reduced at the same time. Earlier, it was mentioned that we should give B.Tech. and whether there has been any adverse reaction from the engineers for this demand from the technicians. Because it so happened in one of the States that when the technicians demanded a higher degree course there was a protest from the engineers. They said even as it is "we do not have enough jobs and if you give degrees to these people what would happen to us". So it was the question whether these courses should be given at all. It thus completely becomes an unacademic issue. I think therefore the point is we should provide sufficient scope for him to improve himself both as a professional man, and as an integrated human being, but whether we should talk in terms of the status of the person is a different thing. As regards the other point Brigadier Connelly made about how to go about getting the industry to recognise. I did not go into it because it is a matter of detail. Here I could give the latest example of one of the polytechnics we started. Normally we are always in a hurry to start an institution. I think in the earlier days whenever we wanted to start an institution we started either in an off centre, a guest campus, and subsequently all the facilities were provided. But we had time to start a new type of institution in Madras where a number of industries were expected to participate. We first said we will not make admissions unless we are sure of what is the response, what is the interest of industries. So we just asked them what is the type of technician they require and at what level. After having ascertained their requirements, a courses committee was started on which representatives from the participating industries not at the Managing Director's level but at the lower working level participated. These people had given their co-operation and we have started after two years of planning courses in machine maintenance and repairs, safety engineering including preventive maintenance. The response to the two courses we have started have been wonderful. I think there is always a way out and we shall always think of improving the situation but certainly we should not think in terms of being trying to sort of perpetuate a system as such because of its own sake.

CONNELLY: My whole idea was that you must make the status of the technician attractive enough to bring in the best type of man. You are now getting these people going into engineering degrees and largely being unemployed. They might go into other degrees whereas with proper guidance and with proper working conditions or the knowledge that they would be treated as individuals in reasonable circumstances, you might attract people who have the qualities of leadership and who can give quite a good contribution to the technical side of industry or any other forms of science.

SKELTON: On this ever-green issue of status of technicians it is often put forward that institutions should be formed to provide a forum for technicians. We had this for several years in Britain and I am afraid they mean very little to industry and nothing at all to the man in the street and this is hardly surprising because the professional engineering institutions have made remarkable impact either. More than once I have been asked if the C. Eng. initials meaning Chartered Engineer after my name means Church of England, whether the doctorate is a doctorate of divinity but it is some measure of what this means to industry. Now this is at the professional level. So what chance do we have of, say, the semi-professional level with this sort of institution. So I am just making a point that I do not think this is an immediate solution. The important thing is the diploma itself, the standard of the diploma itself and the standard of the man, the technician, one is turning out. This is all important.

KOH: Mr. Chairman, I think Brigadier Connelly has raised this question of how to attract good people to the technician field. Now good people will be attracted when the rewards and incentives of taking up jobs in the technician area becomes attractive enough. Well the rewards and incentives to a technician becomes attractive enough when that technician becomes productive enough to the organisation. Here I think it is the quality of the training we provide for the technician in relation to his role in the production sector of the economy which has a significant impact on the nature and size of the incentives that he is going to get. In situation of shortages like the ones you get in Singapore today, technicians and engineers, wages tend to be inflated. But I think a time will come when you will settle-down but the important thing is what can this man contribute? Now I detected a little bit of suspicion about employers being interested not so much in the future of the technicians but what the technicians can contribute to the firm. Now that is true, but a firm is interested in any person who is engaged in economic production and is also interested in the duties of human beings in so far as their contribution to increase productivity arises.

Now, however, there are many enlightened employers who are concerned about improving the quality of their staff internally. Now I work with the Singapore Institute of Personnel Management and as a group of people who are personnel managers we develop programmes for the improvement of people within the firms themselves. Now in that way technicians, clerks, secretaries and so forth, engineers as well, have the quality of their contribution improved a bit to the benefit of the firm which employs them but this is the way by which additional incentives are being provided. Now in reply to Question 5, "How can technician education and training be so organised that higher education, career advancement and promotion prospects are ensured to technicians? I submit that the acquisition of a higher degree or a higher qualification from Technician Certificate to technician diploma, technician diploma to bachelor of engineering, that is the upward movement which is not necessarily true of formalised educational structure. It can be done through improved productivity by broadening the spectrum of knowledge to be more effective within an organisation. It may be that the technology of an individual is adequate for his preformance within an economic production situation. It may be that his productivity can be increased not by additional inputs of technical knowledge but additional inputs of management organisation and other types of knowledge. So I submit that the way out is not necessarily through the acquisition of an additional degree.

CHAIRMAN: It seems to be emerging from this discussion that the problem is as much a social and perhaps a political one as an educational one. I wonder if any delegate would care to comment on that aspect of it because it would seem, as Dr. Skelton in the course of his remarks inferred that that technicians were as much a pressure group as any other body of professionals or semi-professionals and that a sort of type of organisation that has been postulated in one of the papers of a trade association may be better translated in terms of straight out trade unionism. The British Medical Association in Britain are as much a trade union and possibly just as militant, but they are in a better position to extract their price from society but will technicians be in that position or could they be in that position. I should imagine that in certain strategic industries they would and it may be that that type of action will be more effective than a sort of association with an avowdly altruistic aim but strictly mundane sort of other objectives which it hopes to realise and the way to go about that is certainly not to go cap in hand to the powers that be. Now I think some aspect of this might be touched on in this discussion, or to continue Mr. Koh's thesis that higher educational qualification do not necessarily mean that those who attain them are going to automatically benefit in pecuniary terms. They may in terms of job satisfaction or in their greater mobility from industry to industry. That side of it has not been touched on in this discussion either. But I think that if we address ourselves to the question of status alone it cannot be divorced from the considerations that are predicated in the next question and as Mr. Kos's remarks traverse the two, so perhaps we might go on to that one and see what we can get out of that.

PARVEZ: I personally agree with Mr. Koh's remarks. I believe that the status, the salary and other things should not be regulated by educational qualifications. They should be related to performance potential of a particular functionary, of a particular person, technician in this case. But unfortunately in the developing countries and especially in my country we are attuned to certified knowledge and without certificates we cannot move an inch. For instance, we have a new national pay structure. I think it embodies 22 national pay scales. Now the technicians, according to their qualifications were placed in scale No. 8 and you know they have an association or a trade union as you may call it. They agitated and ultimately they succeeded in getting scale No. 10. But the scale for an engineer always starts I think at No. 17 so the technician unless he has added qualification can never hope to attain scale No. 17 from Scale No. 11. This is the type of limitation and limited framework in which we are working. So that is why I say that as long as industry is not attuned to certified knowledge the employer is not insistent on a certificate or a diploma. We might have to provide some educational outlets because only through the educational ladder as I said in my paper that the technician can hope to rise in the context of which I am talking about. But I know in America for instance, I visited certain industries and I found that a person was paid according to what he could do and not what degree he had. In fact, certain technicians are drawing more pay than the engineer but that would not happen for a very long time in my country. So this is a type of contingency we might like to cater to and this is why I proposed that either through associations, professional bodies, attachments with professional bodies, riding on the band wagon itself and through some opportunities for higher technological education that we can pave the way for a technician to be accepted and to be granted the necessary attendant status.

PASKARALINGAM: I would return to what I said about the National Council for Technician Education. Because when we say technician still in most of the countries we find a lot of confusion in the term. Technicians as such are functioning in various ministries and departments, various government agencies, social service agencies, there are the nurses, medical technologists, electricians and most of them may not have gone through a formal education system. In fact a very large number of them have come through informal on-the-job training and training imparted by the various agencies and the industry itself. So before talking of status the question of identification itself seems to be a problem. In fact who is a technician? In my country in fact there are several people who qualify to be technicians but who themselves may not know that they are technicians. In order to give a status, in order to provide for the higher education and the advancement, in order to create and identify, a national Council, some Council, somebody would always be helpful. In fact the very fact there is a Council which is looking after the interest of the technician, looking after their certification, looking after their upgrading itself will put up their status. So I submit that we consider the establishment of some Council at the national level to look after technicians. If we talk of professional bodies and professional agencies it may be to my mind a little difficult because professional associations are normally associated with degree level or equivalent level association. I do not think there are professional associations, professional bodies at the middle level—to my knowledge at least. So if there is a National Council which could look after certification, establish coordination in the training of various agencies and also provide for upgrading of the technicians, I think that would be a welcome thing.

CHAIRMAN: There seems to be two schools of thought on this. One where the status is conferred by some administrative or legislative fiat and Mr. Koh's thesis

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of the sort of usefulness to industry as a sort of criterion. Would any other delegation care to comment on these?

MANANDHAR: In our country one of the main reasons of higher attrition among technicians is because of lack of this advancement in their training and for their studies because government is the major sector where a majority of the technicians get employment. We produce para medical staff, agriculturists, overseers and most of them get employment in government sector itself and whenever you have to enter government sector, the public service commission and all this, they look just for the certificates without a certificate you cannot even get any type of promotion. So that is one of the reasons why after attending this technical study they go for some other thing like liberal arts after graduation. They get good positions and this is one of the reasons why in our present educational system provision has been made even for technicians to go for higher studies, for example, an overseer after having certain years of service he will be qualified provided he is successful in the entrance examination to go for higher studies, like engineering. So this type of provision should be there, otherwise this higher attrition rate I am sure will continue especially in a country like Nepal.

MUHIUDDIN: You just mentioned Mr. Chairman that there are two schools of thought. I think there is a third one and you mentioned it briefly, it is a social question. We have taken status as a stigma. Is it monetary status? If it is a question of a social status it will be conditioned by the attitude of society towards it. If there is a technician, if we pay him some more money or if he gets some better certificate will he be accepted by the society as it is conditioned now. So I think it is a broad sociological question and sociologists will have to tackle this problem.

CHAIRMAN: There is another aspect of it too leading on from what you just said and what Mr. Koh said. It seems that Mr. Koh's thesis may be based on premises which may not apply to other parts of the region. In an expanding economy the yardstick of the market place can be applied freely to all kinds of services whether they be technicians, engineers, does not matter. You name it and the demand for it exists but in countries where there is generally a surplus of labour and fairly highly qualified labour at that, and highly trained, which lacks opportunity. I think that Mr. Paskaralingam's formula is more applicable to most countries in the region than the one in which you get an expanding industrial sector of the economy both in the public and private areas of it.

PARVEZ: On the 5th question, I have to offer a few comments. As I said in my paper for career advancement, acceptability, and promotion, there are three things to be taken care of. First of course, as I suggested in my paper, is a component of broad-based education rather than a narrow specialisation. I think that is very important in order to provide horizontal and vertical mobility adaptability to the technician. This is more so because technological needs are always changing and a man trained in a specialised and narrow field may not be easy for retraining and readjusting himself.

Secondly, I was extremely happy when Mr. Murugasu emphasised the quality of the technician. That is the crux of the whole problem. If the industry gets our people and they are useful to them and are productive then there is no reason why the status

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and salary should not accrue to them in course of time as a matter of routine. So improvement in quality and, especially as Mr. Murugasu pointed out, his own salesmanship, salesmanship not in terms of products but of his person as a functionary, especially the communication skills are more important since technicians not organised as a class suffer from some sort of an inferiority complex and it is better to infuse in them the confidence in their job, the pride of performance as Brigadier Connelly so succintly put in his paper. That type of thing must be provided. The courses and curricula should be designed in such a way that he gets the confidence that he is not an unwanted commodity but is very much needed.

The third point that I would like to make is the need for updating and retraining technicians, as a continuous, activity. This is where I defer with Mr. Srinivasan, when he said that let us produce a technician and forget about them so that the industry accepts them. I somehow do not subscribe to this thesis because if a manufacturer dumps his products in the market and then forgets about them, he is not going to get more orders, he is not going to expand. We are the manufacturers of technicians so to say. So as a technicaleducator, I am very much concerned with what I am producing and in improving his quality, in making him accepted by industry and in seeing him grow, mature and advance in life. Otherwise, my mission, my job would remain unfulfilled. I would not get any satisfaction out of it. This also brings out the need for the institution to keep a liaison with their products and to get the feed-back from them and to improve the programme, and also bring batches of them back to re-train them, to update them, to give them more managerial skills, to find out their needs through sandwich courses or evening extension programmes. These are the three points which are very basic and essentialto any attempt to provide a framework of career growth and mobility to the technician.

KOH: It seems to me that we are concerned about the status of the technicians within the civil service. Now while the civil service in most countries is usually the largest single employer, it is not the only employer. In Singapore, the civil service accounts for only 20 per cent of the technical people we train from our establishments and so it is fair to just take the interest of these 20 percent and develop programmes for their upward mobility. The thesis I advance is that 80 percent of the output on technical establishments are serving in industries so it is industries rewards and incentives to them which determines the status that they acquire. It is true that in many countries the status symbol is to be employed in the civil service and may be Singapore is the exception in that the civil service is no longer the status employer. The technician has a role in the national interest and it is not only the civil service interest but it is the interest of national economic development. So I would like the situation to be viewed from a wider perspective. I do not suggest that we train the technician, put him in industry and dump him. Singapore has a very extensive programme of upgrading also re-training but what I am saying is that the status and the rewards and the incentives that accrues to a man on his entering a job is acquired by his relevance to the organisation who is paying him. The organisation, the educators have a responsibility to upgrade, to improve the quality of the contribution of this technician to his society. This can be done by more direct links. Now if we have to run an upgrading course, let us deal with the industry itself. Is it necessary that you must take a technician who is in employment and say the only way he can go up is to get a B.Ed. or you know be a bachelor of engineering. I submit it is not. He be a technician can be more effective by coming down to some technical college somewhere and learning about systems analysis or personal management, his productivity might improve. It is not a question of improving his technical content but broadening the field of his inputs to improve his effectiveness in a job situation.

RABIEH: Each society has its own value and the status of a technician depends on his value to that society. Supposing in our country the people many years ago were certificate crazy, everything was degree centred, but we tried to change it and I hope you would allow me to read one paragraph of the national development plan. "One of the major bottle-necks was the value attached to the educational certificate, the result of which was qualification based on paper certification—certificates irrespective of the holder's aptitude, knowledge or specialisation. Therefore, the government planned to establish the uniform evaluation system which will be based on experience, skill or specialisations to be used as a criteria for employment".

CHAIRMAN: I think that comment was extremely relevant to the situation of a lot of countries because although in a sort of highly industrialised environment such as that in Singapore the yardstick of money may be an index of the social status, in societies which were emerging from customary societies to perhaps semi-industrialised societies that is totally irrelevant.

SNELSON: I should merely like to ask if we should not overlook the fact that there seems to be a link between question No. 5 which we are talking about now and question No. 2 which we were talking about earlier on in the morning. Because it seems to me that those who are the products of what have been called crash or emergency programmes are apt to be permanently handicapped in their careers. It is highly important to make sure that those who do undergo crash programmes should have every opportunity subsequently to complete their training through in-service arrangements of some type, in order that they themselves may become qualified and can thus advance higher up the ladder.

CHAIRMAN: any further comments? I think we can close off the discussion on Questions 4 and 5.

CHAIRMAN: MR. AINUDDIN BIN ABDUL WAHID

CHAIRMAN: Now we come to Question 6.

Q. 6. "How can industry be made to play an effective role in the education and training of technicians? What innovations are possible in this area?"

GUTIERREZ: This is to reminisce the wonderful job of the Colombo Plan group who went to the Philippines in 1966 and they put up a Seminar on "Approaches to Co-operation between Industries and Institutions in Technical Training" in the economic development of the country. I salute to the group who went there because it was really very effective. Before 1966 the industry people had the attitude of not carrying the products of the schools. They were having their own programmes of training only to find that it was more expensive to train people within industry.

Because at the 1966 seminar we invited industrialists and educators together and we had lengthy discussions about the importance of co-operation between industry and institutions. From that time on they began to recognise the on-the-job training programme and at this time almost all the schools are having this on-the-job training programme with industry, small and big industries. We give them a part in the organisation and the enrichment of the curriculum. They were able to point to us the weakest point of our curriculum. After this of course more employment followed, and larger numbers of graduates of our schools were hired by the industries. Industry really has played a very important role in the programmes of the training of technicians in the Philippines.

MAISEMA: I said this morning, the technician training is now in our country and the system we are following is that those who go for technicians courses at the technical college are sponsored by industries. They have to be employed by industry before they are taken in at the college. This ensures the close relationship between the college or the institution and particular industries who sponsor the students and we find that the industry themselves take very active roles in the training of our technicians. Our craftsmen on the lower level have also to be sponsored or employed either by the (public sector) or by the private sector. This is one way of ensuring that the industry plays a very effective part in the training of technicians.

SUBRAMANIAM: We in Fiji have Fiji National Training Council which has been established by an act of parliament. This Council liaises with industry and industry pays one percent of the turn over as a cess for Council.

RAFIK KHAN: Industrial participation in training of technicians is a very important factor. The one thing I find is that we tend to leave out the industries in planning the programmes for technicians or craftsmen training and if and when we invite them we find that the representatives of industries who come to these meetings or take part in our planning people who are not in a position to make a decision for the industry concerned. The industry, because it is invited to participate in the planning of courses, sends somebody but not somebody who would be really effective and be in a position to help the institution or the body concerned in planning the courses on the needs of the industry concerned.

ASISTIN: I would like to go back to the concept advanced here by Dr. Chandrakant, when he said that technician education is a shared responsibility of educational institutions and industry. But the question is how to get this "shared responsibility from the industry. May be the State can use its cohesive power in this regard by means of legislation, by means of levies or through taxation measures but the question is would this be a better method compared with the persuasive method to be used by the State in this regard. Some industries do not like the idea of being coerced into sharing responsibilities. They would rather sit down and come clean with what they think is best rather than being coerced into sharing responsibilities.

CHANDRAKANT: The whole issue of co-operation with industry must be looked at in a much larger national context. When we accept the thesis that whether we train a technician or an engineer or a skilled worker, it is an investment that the country is making in human resource development. It is a part of the investment in economic development as well. Following from that you are going to develop a national system of technician education. When it is a national system it is not as though that institution alone has to play a part. The system does necessarily involve the industry as well. Therefore the concept of shared responsibility is not merely a legislative approach it is inherent to the developmental system as such. How each country should deal with that problem will vary according to the conditions of that country. A reference was made to Fiji's legislation of a cess on industry to provide the funds but that may go to some extent to bring the industry into partnership with education but much more than a cess is needed. That is the industry must be made consciously responsible for the training and the system itself should evolve out of this co-operation. Unfortunately what has happened is that the system has stood apart from the industry and now you are seeking to find the means of co-operation. One of the ways in which this could be further pursued is in the educational process itself instead of mearly teaching a curriculum which is built around a series of subjects somehow connected why should not our curriculum be developed in such a way that it is centered round the problems of industry as a sort of project approach to this, like problems are taken from the industry and the total process of teaching is built around it and in that way industry can be made to feel it is participating in this process. There are various ways and means of bringing in once you accept the concept of a total system in which the industry and institutions must share this responsibility.

CONNELLY: I do not like to speak for Indonesia but my understanding is that after the Colombo Plan Seminar was held in 1969, the Government of Indonesia formed a Council of Manpower—of industrialists and educationists to advise the government on vocational and technical education and training.

HUQ: I think it is in the interest of the industry itself that industry will play a greater and much effective role in training the technicians and to that end perhaps some of the suggsetions that have been raised on the floor that there has to be some government legislation and a sort of a compulsory levy which would go to the extent of financing the cost of such training. At the same time we might as well ask representatives of the industries to sit on the acadamic councils of the institutions so that they also take part in the formation of the courses and sometimes people from the industry may come and give lectures to the institutions and take people from the colleges or from the technical institutions to the industry, train them for a certain period of time on what jobs they would actually be required to perform when they are employed in the industry. These are some of the measures which may be adapted in further utilising what Dr. Chandrakant says "shared responsibility" of the industry and the institutions.

PHONEKEO: I can see two extremes in the training of technicians. For instance, in my country because of the first stage of industrial development we have only small industries and also these industries are short-term industries. It seems industries do not care about the training of technicians because they are not looking for long-term but for short-term profits. On the other hand in developed countries I may say that for large industries they tend to organise the training of technicians themselves. These two extremes I would think are not effective, they should come out with some middle way. To this end I believe that the authorities concerned for instance the planners, educators and also industry should come together to form a Committee or Council so that proper planning for the requirements of technicians can be made. For better co-ordination between technician education and industry, I believe that they should have some sort of sandwich training between industries and education. For instance, in the case of the Electricity Board in Laos they train their own technicians, their courses in school also give on-the-job training. So in that way the employers can look after these technicians more closely and also can have some assessment and advise the training centre how to direct the training to meet their requirements. This can be enlarged in a national scale I think to serve better national interest

WAHYUDI: The basic thinking is that no industry will become a volunteer to continuously assist or subsidise the technical education. So I think in order to make the industry start to play an effective role in the education and training of technicians each government will have to push the industry by making a law in order to arrange it.

RABIEH: I would like to talk about our experience in my country in this field. According to legislation we have the industry obliged to pay two percent of their income to finance the training of workers, semi-skilled workers, skilled workers and provide some on-the-job training. I think that we have a good result from this activity. Besides this the government encouraged the private sector to establish the training unit adjacent to the factories through the long-term government loans and just now many industries such as petroleum industry, petrochemical industry, copper industry, steel mill industry, have their own training unit. Besides this we established an industrial education complex which offer courses, sandwich courses, approach or method. Most of the students at this complex receive scholarships from industry and according to the nature of the sandwich courses spent some of their time in the institute and some time in industry.

CHAIRMAN: Before I call Mr. Koh, I would like just to make an observation on the paper presented by Mr. Parvez, yesterday. In his paper on the need for co-operation with industry there is a sentence in paragraph 5 which says, "there should be restored a two way traffic between institutions and industry". I am just wondering whether this was the situation before or rather whether there was two-way traffic before in Pakistan and then it was lost. If it was lost why? This may help us later on in our discussion.

KOH: I would like to talk a little bit about the Singapore experience in what has been a very successful co-operation between training and industry. We have three technical colleges in Singapore, two of which are independent on their own, they have a board of directors, a board of governors comprised of people from industry as well as from the civil service. The civil service provides for the education and finance and labour contributions. Now the third technical college is directly under the industrial training board in which I work. The Industrial Training Board itself is a tripartite representation from government, industry and the labour unions. We have 15 members and this is split within the three groups of people. So we do provide opportunities for workers to put up their views also. At this first tier below that we have what we call trade advisory committees. These people advise on metal-trades, hotel and catering trades. The Industrial Training Board has some 12 trade advisory committees who are specific to the different trades, electronics, aeronautical and all that. Now in the trade advisory committees the total composition is from industry. The Industrial Training Board provides the support, secretarial, research and other administrative services but the Chairman and all members are from industries. They determine what is the nature of the programme and they lay down broad principles. Below the Trade Advisory Committees we have what we call a curriculum and syllabus sub-committee and here again our professionals, professionals from the Industrial Training Board, work in close liaison with the training officers and training managers or training supervisors of industries. So we have co-operation with industry at all levels and this has been particularly so as most of the training officers within the industry are actually former staff of the Industrial Training Board and the Technical Education Department. We have got a very cordial working relationship and a very effective co-operation. Aside from the advisory roles that we have, we have what we call a National Apprenticeship and Trade Testing Council and now this one decides on the nature of apprenticeship agreements and the quality of apprenticeship training, and it also sets the standards for national trade testing certificate. Here again the industrialists who sit on these committees are the people who determine the direction in which these things should go. The civil servants who are on these committees are given the title of "in attendance", I mean they have no executive decision making process, they advise, they implement, they research, they pick data. Well, this is at the organisation level. In the operational level we have in-plant training schemes. Now we negotiate with industries and say well we got a number of trainees who have been through institutional training in this particular trade and we would like to give them some experience, say, four months of attachment with our teachers. Now we release our teachers for work in industries for upto 4 months, 6 months, we carry their wages, we carry their workmen's compensation and all other contributions and they work for industry to get the industrial experience and we do that with our students also. So there is in-plant training within industries. We also reciprocate by receiving from industries students who come into our institutions for very specialised and very specific programmes. Now a firm wants to set up—you visited Selangor Pewter yesterday. Selangor Pewter wanted to establish a factory in Singapore and said but we did not have staff. So we looked at it and said OKAY now what is the sort of staff you require. We will launch a crash programme for them and today we have in Singapore a very successful Selangor Pewter Singapore Ltd., operating, producing what you saw yesterday being produced in Singapore and that is one example. When rig builders wanted to start this rig construction in Singapore they came to us about 9 months ahead of time and said well our dockyard is going to be ready in 9 months time and we want 2,000 workers. And so we picked them up, trained them within our institutions on a crash programme, released them and we had a cycle—a crash programme does not end with the first 3 months project it is cycled back until the students reached the required standard. So this is the way we have co-operated. At this moment there is no legislation which says this must be done, industries must do this or do that. We carry the institutional cost of the training, the industries contribute a nominal sum, they sometimes contribute in terms of extras and we have been very successful in that where we have co-operated with industry to develop programmes to their needs and we tell them look we do not have the equipment, they have bought this equipment and they say this equipment is on loan to you for the duration of this training programme but at the end of it all, they say, this equipment will remain in an institution on indefinite loan. So every year we submit a return to certify that this piece of equipment is still there. They need it for their accounting purposes. But to all intents and purposes that piece of equipment does belong to us. So this is the sort of co-operation that we have been getting from the industry and I think we have been very successful there.

CHAIRMAN: I would like to clarify one point Mr. Koh. You mentioned about Trade Advisory Committees and National Trade Testing Council. Are these programmes then related to technician training or craftsman?

KOH: At this moment we are leading on towards a higher level. We have started National Trade Testing at a lower level. Now we have three grades of skills that we are going to do. Grade III, II and I—our Grade I is at technician level. We have not reached that, but we have reached Grade II at this moment.

PARVEZ: I plead guilty to the use of a careless word. Actually what I meant was the establishment of a point of contact rather than restoration because even though we had only superficial contacts with the industry, these cannot be termed as meaningful co-operation. While on this topic, I may add that we had a very useful discussion in sindicates and plenaries in the Colombo Plan Staff College, Singapore. And we adopted a certain framework of action and it started with the identification of barriers first. What is impeding this process? Is it because of the lack of motivation, is it because the lack of information, is it because of the limited economic horizon? Once we have identified in a particular context in a country, in an environment then we can sort of chalk out our remedial action and we also advocated there that we should have a multi-level approach to establishing points of contact with industry at various levels—at the national level, at the State level, at the regional level, at the institutional level. In short the educational system has to assume the role of a nagging wife may be and to get its rights by persuasion, by normative education, by cohesion, and lastly—I think this point has not been mentioned—so far in this discussion—by incentives because to start with if you want to persuade somebody then, for instance, when we set up a new industry then we always give tax holiday to the enterprising, to the entrepreneurs—for five years no tax, OKAY you come on. You know somesuchthing may be which will give some tax benefit concessions, holidays or something which may induce, you know this is a process of inducement to once bring him out of his shell and then may be later on, once he is there, he will start realising his obligations to society and to his own industry which is more important. And there can be many methodological approaches in bringing about this co-operation—you can have advisory council you can have interchange of personnel, you can send the students for orientation, to industry, you can associate the industry in pre-selection of students at the time of enrolment, you can associate the industry in the examinations, you can set up training centres in industry with some levy systems and so on and so forth. There can be many many ways in which this can be brought about. What I think as I said yesterday, I think this is the single most obstacle against the working to status in the acceptance of technician by industry because without industry, without partnership, without shared responsibility what we do in isolation does not take us very far.

SEN: We have in our country an Apprenticeship Ordinance but we are not achieving the desired results as yet. So long as the industrialists would not believe or realise that money spent on apprenticeship training is a long-term investment, no result could be achieved. They are hesitant to take the boys from the polytechnics or the technical training centres rather they are inclined to take boys from the factory gate and to exploit their cheap labour. We have our National Advisory Council and the industrialists association is there, we are now forming the Trade Advisory Board so that they could also associate with us for you know framing the curriculum and they could see with us and to increase the co-operation between the user and producer.

CHAIRMAN: I think we have discussed enough on that question. It seems to me that quite a number are suggesting legislation and there are those who suggest persuasion, may be should be a mixture of both, there may be legislation but at the same time there may be some sort of incentive to those industries or factories that would provide training facilities. Now we go to the next question.

Q. 7. "In what areas should research be undertaken as a matter of priority to relate technician education and training to the socio-economic needs of the Colombo Plan region?"

SHIN-BOK KIM: Now I would like to suggest that two possible areas of useful research and the first one is partially related to question one. I think question 1 overlaps a little with Question 7. What I would like to suggest here is a kind of key study as we discussed in the morning session no technical education system can be directly imported or adapted from other countries. So we have to modify and we have to adapt that kind of system to meet our own conditions even though that system was so successful in the other situations. So extensive case studies of technical education systems of various regional countries may be very useful. As you may know that Dr. Waterson wrote a book called "Development Planning" sub-titled as "Lessons from Experience". That book dealt with very concrete cases of development planning and has been used as a very useful guide for development planners in various countries. So that is the one kind of very useful research in this field also. The second area for useful research will be extensive follow-up study of the graduates from Technician Education Institutions. That follow-up study is actually very difficult even when we talk about socio-economic needs of industry, we really do not know what the present socio-economic need is in concrete basis. So I think that kind of follow-up research for the graduate from technical education system will be very useful to meet the contents of education to the socio-economic needs of the industry.

CABOT: Mr. Chairman, I would like to put a question to Mr. Shin-Bok Kim from Korea just to get the record straight. You mentioned the need for case study I presume he meant of regional countries individual systems of technician education. I am concerned as to whom Mr. Kim suggests might have to carry out these case studies.

SHIN-BOK KIM: Well I think that will be performed either by international organisations like Unesco or other organisations and why do not the Staff College perform that kind of research too.

CABOT: Sorry, to keep coming back Mr. Chairman but I would like to mention in front of my Director sitting up there next to you that he has not yet seen the report emanating from the recent Unesco Conference in Manila. You know I have one—we have got about two years work each I think ahead of us in research studies which Unesco wishes the Colombo Plan Staff College to do.

PARVEZ: I just again referred to my paper in which I listed a few priority items for research and may be many others could be found in addition to that. I think the most important areas would be teacher training. I think teachers being the major instrument of change, how to prepare a motivated well qualified, balanced and well educated person who takes pride in his job and who can deliver the goods, who can bring about the necessary change. Another area in addition to the one that I have listed here would be the selection of students, I mean the selection of the right type of students. Another area could be a remedial pre-training programme. You know sometimes the product of secondary schools, they are deficient in certain competencies and skills and may be some remedial pre-training programmes could be designed for their benefit. Of course the involvement with industry is also a priority subject and evaluation techniques. I think this is a question which has bothered my country, may be the same problem in other countries. How do you evaluate a technician? Who does it? Is it a public examination, is it continuous assessment, is it the project approach, you have a three days, four days trade test may be or some thing and do you bring in external examiners and so on and so forth. These are some of the areas that I could think of at the moment.

CHANDRAKANT: Of course on the plane of Colombo Plan that means we will have to identify the common areas which lend themselves to research on a cross country basis. There are problems no doubt which are typical or characteristic of one situation within a country. They lend themselves to research. At the same time there are areas which cut across all the countries of the region and assume a form of commonality and as Mr. Parvez said Teacher Training is one of the major issues on which much research is needed. But here again, it is not mere by the didatic or pedagogical part of the things but integration of the pedagogical didatic processes with the subject knowledge how to bring it about which may not be of special significance in non-technical forms of education but in technical education this is of great importance because there is a practical content, there is the theory and there is the teaching and the learning process involved arising out of it one might go even further and suggest that how to integrate theory with practice itself which may go further into the area of curriculum development itself because you cannot conceive of curriculum without the teacher, without the subject content, without the integration of theory and practice, without the evaluation and so on. So one could unify all these things into a major area of educational technology itself which includes curriculum development, teacher training, integration of theory and practice, integration of didatic and the pedagogical processes with subject covenant in the preparation of a teacher and so on. I mean this is a common area to all the countries in the Colombo Plan region. Similarly the issue of co-operation between industry and institutions. Now if one were to think of, if one were to suggest or if a country were to undertake a sandwich programme. As I explained yesterday sandwich programme is not two componants brought together in an irrelevant manner, there is close connection, there is relevance, how to establish that relevance, how do we integrate these two. This becomes an important area of research. One may think of it also as an area of innovation—in fact research leads to innovation or innovation creates further impetus for research and so on. It is a cyclical process, one leads on to the other one, that means the whole thing should be visualised as a continuous process.

KOH: In my country report I identified five areas in which we suggest that fruitful research might take place. Now this would be at the national level itself. I will speak a little later about the role of the Colombo Plan Staff College. Now first and foremost this manpower studies is to determine the nature and the quantity of technician skilled manpower required. I think Dr. Chandrakant referred to the importance of manpower studies before we decide what we want to train. Now having got an indication of the quantity and the nature of the skilled workforce that we want we would like to learn about how to develop reliable selection processes to enable us to predict with an acceptable degree of accuracy the potential of an individual for the course he wishes to take. Now we would like to cut down on training wastage and personnel frustration so if we can identify the type of person who could successfully complete this programme this sort of wastage and frustration would not arise. A third area is the identification of skills and attitudes required for a job to enable training to be more meaningful and directed to the job for which a person is being trained. Lastly, we have been talking about skills but there is an important component to job execution and attitudes and so forth. Now a third one is the development of evaluation procedures which will tell us whether the programme we are developing is in fact the right programme for the development of the type of people required, the skilled people required. Now a fourth area is to develop reliable testing procedures to evaluate a person's real attainment in the course he follows. I am afraid that most of the current testing procedures, test memory, ability through theory test but such testing fail to reflect the perceptive and behavioural attitudes desirable for successful execution. We would also like to know more about how do we test achievement or attainment in psychomotive skills. In other words, how well a person executes performs on a machine with a welding torch and so forth. So these are the areas in which we think testing research should be undertaken at the national level. Now in terms of the role of the Staff College—it is desirable that there should be some commonality. Would the Staff College consider providing training in techniques for such research procedures. So it is a question of how—Dr. Chandrakant can talk about a national planning commission doing a macro-manpower study now at the technician educator level we need to do the micro-studies. But how do we go about doing these micro-studies? How do we go about ensuring that the testing system we use is the right one? These are some of the roles which I suggest for the Staff College.

CHANDRAKANT: I do recognise the importance of the list of items suggested in fact they are inter-connected if I may put it that way. Because when you start you have to start in a very logical way and therefore one must know what precisely one must do, what is the objective, that means we have to really start with the question, in some of these developing countries, they start with a question of analysing who is a technician, what does he do, and what are the occupations that he will hold, in which sectors of the economy and from there we have to derive a sort of an occupational analysis or an accurate analysis of the technician. Then study what should be the knowledge, component, skill component and other things needed and then proceed further to decide what type of curriculum should be structured. Then the evaluation, techniques, etc., should follow from that one. Now if we were to deal with these things in a logical manner then the evaluation should also include the feed-back on the product itself that has been trained. Now how to develop the techniques for that purpose. I quite agree that these are the crucial areas in which much research is needed if we were to say research is inappropriate I personally feel that investigatory type of work must be carried out, and in this the experience of some of the countries which have already moved a long way in technician education development will be of value. This is where the question of case studies will come up. The experience, good ones, the successful ones, the failures are also important, that is if we are to avoid some of the mistakes which have been committed by other countries we must know in advance why those mistakes are being committed and how we should ensure that we do not repeat the same mistakes.

LA SERRA: I would just remind if necessary that may be a good result will come from the co-operation that could be understood between the Staff College of the Colombo Plan and the Asian Manpower Skilled Development Programme that is just under approval by the United Nations and where everybody is ready to co-operate with the Colombo Plan Staff College and to take a shot high not to overlap the activities so that the result will be a more broad knowledge and activity of the two institutions.

CHAIRMAN: I think all of us agree that the Staff College will have a big role in this. As our time is running short we are going to the next question now—Dr. Chandrakant has agreed that Questions 8 and 9 to be taken together.

Q. 8. **"What steps may be taken to develop non-formal technician education and training in co-ordination with the formal systems in the Colombo Plan region"**

Q. 9. **"How can an innovative approach to curriculum design and development be encouraged?"**

PARVEZ: Not much headway has been made in Pakistan about this non-formal education and still much less about informal education. We have some non-formal programmes at the skilled worker level but at the technician level we do not have any programmes. But in Pakistan we have established a People's Open University in Islamabad. The objective of this University is to provide non-formal and informal education to cross-section of the masses: teacher training, technician training, skilled worker training, and host of other activities, adult education and I think this is the type of institution which can probably on an organised basis handle such activities in the context in which I am talking. This would be an University without walls, there would not be many big complexes and buildings and so on and workshops. A small skeleton staff: professors and teachers who by correspondence, by the radio, by T.V., in collaboration with the existing institutions, polytechnics, colleges, schools teacher training institutions, would arrange these programmes, it is still in the embroyonic stage so I cannot say whether what measures of success it would achieve but

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I have every hope that this institutional character to this whole effort may in the long run prove beneficial atleast in the Pakistani context.

CHAIRMAN: Just for clarification, did you say this is an university for the training of technician level of manpower?

PARVEZ: No. It has many objectives, this is a People's Open University. It had objectives of teacher training also, primary teachers for instance, skilled workers for instance, or technicians, adult education or social education and a host of activities, it would have many sort of departments but the essential idea is that it would not be land based in that sense the ordinary conventional universities are. It would act in collaboration with the existing systems and institutions and would impart an extra dimension through non-formal, informal, correspondence, radio, T.V. etc., to promote the concept of education outside the four walls of the school so to say.

SRINIVASAN: I think the very nature of consideration of non-formal education presupposes different levels of pre-education or pre-vocational training or pre-technician training itself. Multi-level entry point also therefore is envisaged. So I think along with the other forms of non-formal education suggested. I think one important aspect is the correspondence courses also.

CHANDRAKANT: Mr. Parvez has widened the scope of the term non-formal to bring in the other components of the manpower spectrum and also he has brought in the correspondence courses, the radio, television and the other programmes which are all outside the classroom structure or institutionalised framework. But what I visualised and in fact my own experience is that when we talk of technicians or technician education system we tend to over emphasise the formalised education that takes place in a polytechnic or in a technical institute. But experience has shown that a very large proportion of these technicians come from the non-formal system, namely apprenticeship either under legislation or non-legislation, training on-the-job and in a host of other ways. So no system of technician education is complete unless it takes in this major component of manpower development that is taking place. So how do we develop it further. We must first recognise that it is an important coponent. It plays a major role and it does not come into conflict or clash with the formal system. So how should these two be made complementary. It is there that many innovative approaches are needed including a certain amount of research. We talked about upgrading the skills, upgrading the skills is not merely a question of improving the manipulative part of the skills of the individual, so also developing his mind, giving away a certain minimum amount of theoretical knowledge. So the part-time courses whether you call them part-time courses or correspeondence courses all becomes relevant and we must recognise that as Mr. Parvez himself explained earlier in one of his interventions that no industry recognises a technician only because he holds a degree or diploma or some other certificate. That means to say that a large proportion of development of technicians takes place within the industry and the formal system must respond to that one and response to my mind has to come at different levels and in different forms and the most important to my mind of these part-time courses or even if you accept it the apprenticeship as a form of technician education, training and development it has to be supplemented by a part-time course or some other form of institutional training. So there is much scope for co-ordination between the formal and the non-formal system. Of course each country has to deal with that problem according to the conditions prevailing in that country. But first of all the important thing is the recognition of the non-formal system itself and next the need to bring about co-ordination between the formal and the non-formal system.

CHAIRMAN: As time is running short I will rush you through these various questions. Now we will go to the next Question.

Q. 10. "Should high priority be given to the development of educational technology (both hardware and software)?"

CHANDRAKANT: I relate this to partly to the cost of technician education and partly to the processes of technician education. As I explained at one stage yesterday, there is the danger of over capitalisation of our technician education systems, particularly in developing countries which cannot afford to spend so much or make such heavy investments. For instance, in India in my 30 years experience the cost of establishing a technician education is going up at an annual rate of 15 percent. Now you can visualise what would be the magnitude of investment one has to make. Now what educational technology would be brought to bear upon minimising this cost. Heavy investment is on laboratories and workshops. There is a capital investment apart from the buildings. Now if you look at the utilisation part of the laboratories and buildings it is not optimised. Much can be done through educational technology to minimise this cost and give the students the same type of laboratory experience. For instance, we can provide scope for open ended experiments which do not demand highly sophisticated equipment but nevertheless develops in the students the same creativity and the same originality, giving them the same experience in investigative approaches. Secondly, whenever there is a big shortage of teachers, can we develop instructional materials which will be in the form of programmed learning which will not only accelerate the learning process, which will improve the learning itself, because programme learning has a multiplier effect it can be developed at one central place it can be used on an extensive scale. Similarly can be developed other audio-visual aids which are less expensive but whose effect is nevertheless extensive and also purposeful. Now these are some of the major areas which are of special significance to developing countries if you are really concerned with the cost of education itself. Secondly, how do we utilise the resources of industry? It is not merely a sandwich programme or a co-operative programme can a certain part of the learning process take place by sending the students to the industry or can we as I said earlier take a live problem from the industry and build the total earning in the teaching the technician around it—a sort of a project approach. Therefore it is not merely a question of an individual teacher trying to develop some of these innovative processes or this new approaches in educational technology. I think it should become integral to the total system of development of technician education itself.

CHAIRMAN: Now we come to the last question.

Q. 11. "What topics may be suggested for consideration at the next Colombo Plan Colloquium?"

RABIEH: I would like to say fortunately or unfortunately that at this Colloquium I have not heard about vocational guidance and counselling, may be vocational,

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technical vocational and guidance and counselling can be one topic in the next Colloquium and at the same time may be this topic can include to improve the relationship between the educational units or systems with the industry.

MAHENDRA: I thought it might help the delegates to come up with some suggestions if I were to refer to some of the topics that have been discussed in our Colloquia in the past. In fact the topic that Mr. Rabieh referred to Vocational Guidance was in fact a subject at the Colloquium in Karachi in 1973. These then were the topics:

> "Problems inhibiting intra-regional training; manpower planning; planning technician education and training; employers responsibility for developing middle level manpower; the need for a regional staff training and resource centre for technician training; this was in fact the main topic at the Singapore Meeting in 1969 and it was out of this that the whole concept of the Staff College emerged; technician teacher education and training; third country training; administration of technician education and training programmes; the migration of scientists, engineers and technicians; planning of technician education institutions".

A similar question to the one that has been listed in this paper was posed at the Colloquium in Manila in 1971 and a view was expressed that it would be useful if at these meetings we were to have one subject of a generalised nature to be followed by two very specific subjects and we have in fact been trying to follow this practice.

SEN: It seems nothing has been done for the skilled level training, so I think something has to be done for you to know ways and means to find out the best ways for this skilled level training and their utilisation.

LA SERRA: Vocational Guidance was not only the main item of the previous Colloquia but it has provoked the hope that all these things which the Colombo Plan countries have discussed among them and adopted will be discussed and adopted as an international recommendation and convention at the 60th Conference of ILO in Geneva next June. So the results of this Colloquia are not just remaining here but are going where they are adopted by all the countries in the world as something that must be recommended as an internal policy of the countries. May be it will not be the main item of the next Colloquium but something about the evolution of this concept and the adoption of these policies is reflected may be it will be something that the next Colloquium will be very useful as the delegate from Iran suggested to be at least mentioned because some new things arise and it will be useful to know them in details. The second point is that we have spoken many times about evaluation of training programmes about what we are doing and so on. Now may be one of the items for the next Colloquium will be the examination and analysis of what evaluation because evaluation can be done in respect of the institution where the training is done and in respect of the community where the results of the training are just utilised and the results of the training in the country's development. These three different points of view about evaluation would be one of the interesting items at the next Colloquium.

ASISTIN: Mr. Chairman, a minor suggestion—it is not a suggestion on the topic but a suggestion on the composition of the delegates to the next Colloquium. May I suggest that if at all possible one member should come from the industrial sector

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and this has been voiced in many of our deliberations so that they would be given a chance to be heard and to expound their views in the matter of industry, education and co-operation in technician education. At least one member should come from industry.

PASKARALINGAM: I would suggest the topic "Co-operation and Rationalisation of Technician Education Programmes in Member Countries". At the moment as is evident within a country there are various patterns and forms of technician education, non-formal, informal and formal and also various other apprenticeship programmes, etc., and there is also duplication of technician training programmes going on especially from my own country's experience, various agencies are duplicating the technician programmes. There is ample scope for rationalisation of the technician education programme. So I would suggest the topic co-ordination and rationalisation of technician education programmes within a country.

KOH: Mr. Chairman, I like to support the ILO proposal that evaluation be the main theme for the next Colloquium. This could be evaluation of a programme, evaluation of an individual's performance and it might go on to testing techniques and so forth. I would suggest also a minor theme. It is related to evaluation and that is considerations of—it has slipped my mind—any way let us take evaluation as the main theme for the next Colloquium if I may lend my support to that.

A minor consideration that I wanted to raise was a Trade Testing System and Certification system that is what I thought was a follow-up from evaluation techniques.

PARVEZ: May I suggest two themes for consideration. One refers to one of the suggestions of Mr. Koh and we also I think discussed it in Singapore, that is the optimisation of resources and waste prevention and when I talk of resources I mean all resources, students, teachers, physical facilities and other community resources. This optimisation as well as coupled with it waste prevention, there is lot of wastage. Second topic I think in this Colloquium as well as in one other Colloquium that I attended in Karachi there was an element of ignorance from the delegates about the information available, about the valuable body of knowledge and information that has been collected as a result of Colombo Plan Bureau's activities. So I was thinking may be at the Bureau level and more important at the country's level what mechanism should be adopted for a wider dissemination of this information and knowledge that is collected as a result of all these activities.

GUTIERREZ: I want to talk about the topic to be discussed next time. But I have been looking at out-streamer the last part is Regional Technician Training. I would suggest that it should be Regional Technician Education and Training as a correction to the streamer we have there. Should it not be Regional Technician Education and Training rather than Regional Technician Training? Because there are two meanings when you say Technician Education is different from Technician Training.

CHANDRAKANT: Would it also not be covered by co-ordination and standardisation?

KOH: Yes, it will be covered.

CHAIRMAN: Any other Comments? Well if there is none then we will close the discussion.

SESSION FOUR

CHAIRMAN: MR. I. K. McGREGOR

PRESENTATION OF ANSWERS TO COLLOQUIUM QUESTIONNAIRES

BANGLADESH

1. **What are the objectives of the system of technical education in your country?**

The main objective of Technical Education in Bangladesh is to meet the requirement of the following four categories of Technical Manpower in the Public and Private sectors, Autonomous bodies and utility services.

(i) Technologists (Engineers, Chemists, etc.).
(ii) Technicians/Supervisory personnel.
(iii) Skilled worker.
(iv) Craftsman.

Four Engineering Colleges, 16 Polytechnics, four Mono-technics in the Government sectors offer Degree and Diploma courses. Five Technical Training Centres including the one Marine Diesel Training Centre under the Ministry of Labour produce skilled workers and 35 Vocational Training Institutes, 13 Evening Trade Programmes attached to the Polytechnic under the Ministry of Education offer certificate courses for craftsman. The five Technical Training Centres and 35 Vocational Training Institutes have a seating capacity of 1,477 and 1,680 respectively.

The H.S.C. passed students of only pre-Engineering courses are admitted in the Engineering Colleges and the duration of the courses are four years.

The Polytechnic Institutes admit S.S.C. passed students in their three years programme for producing Technicians/Supervisory personnel. Most of the courses of the Technical Training Centres which produce skilled workers admit S.S.C. passed students with a duration of course for two years. The Vocational Institutes admit Class VIII passed boys in their two years programme. The Education Commission who have already submitted their recommendation will bring a revolutionary change in the present education system as well as technician training. The recommendations have been made to keep open the ladder for the really meritorious boys so that from the lowest level they may obtain the highest education.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

The First Five-Year Plan estimated a requirement of 75,000 skilled workers and craftsman. In order to meet such a huge requirement 112 Vocational Institutes and six (6) Technical Training Centres are being established. The duration of the courses being introduced will vary from 6 months to 2 years. Many new courses are being introduced in these new Training Centres to meet the needs of Agriculture, Rural Electrification and Road Transport as recommended in the report of the Evaluation Committee.

3. **Do Technicians enjoy a status commensurate with important work they do? If not, what measures are planned to improve their status? Are There separate professional bodies for technicians?**

The technicians do not always enjoy status commensurate with the important work they do but National Pay Commission and Service Re-organisation Committees are paying full attention to this problem. The skilled workers andcraftsman have no separate professional bodies. The Engineers have the Institute of Engineers. The Technicians/Supervisory level have the Institutes of Diploma Engineers. The Matriculate skilled workers and craftsman may enrol as students in these Institutes and if they can pass studentship, they are enrolled as student members and subsequently if they can pass Section—'A' and 'B', they become Associate Members which is equivalent to the B.Sc. Degree in Engineering. Moreover, Colombo Plan Seminar on National Planning of Vocational and Technical Training held at Dacca from 24th to 27th February, 1975 submitted recommendations for taking following steps to improve the social status of the technically and vocationally trained personnel:

(*a*) That the sense of dignity of labour may be inculated in the minds of students of primary and secondary schools by introducing manual work in their curriculum.

(*b*) The wage structure and working conditions of technically trained personnel be made more attractive.

(*c*) Correspondence and part-time courses for vocationally and technically trained personnel be introduced in institutions of higher learning to enable them to upgrade their knowledge, skill and education.

(*d*) National awards be instituted for best instructors, best trainees and also for best performance, innovations and inventions.

(*e*) Technically qualified persons should have opportunities open for appointment to higher position in policy making agencies in the relevant fields.

The above recommendations are receiving active consideration of our Government.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

As stated in para 3 above the technicians may enrol themselves as students and may study for studentship and then they may appear at the examination of A and B Section of the Institute of Engineers. The Supervisory personnel with Diploma are exempted in appearing at the studentship Examination and may directly appear in the section A and B examinations of the Institute of Engineers to qualify them as Degree Engineers. Moreover adequate provisions have been made for the professional advancement of the technicians in the Education Commission's report which will be shortly implemented.

5. **Is any research being undertaken in technician education? If so, name the institution in which this is being done?**

The Planning Department, Manpower Analyst of the Ministry of Labour and the Evaluation Team set up by the Labour Department have undertaken some research work as to the requirement of technicians but the gradewise and tradewise survey as to the requirement of technicians has not yet been done but this is also receiving active consideration of the Government.

6. **What are the important technicians education problems in which research could usefully be undertaken in your country?**

A research and statistical work could be undertaken to find out the dependable data on the requirement of supervisory level technicians and skilled workers so that training could be provided in the fields in which there are admitted shortages of skilled manpower. Nothing can be more wasteful or socially undesirable than to give vocational training to anybody who finds on completion of the training that his new skills are not counted.

7. **Does the technical education system provide scope for innovation?**

The present system does not provide proper scope for innovation but the Education Commission set up by the Government have given much thought to this problem and I am sure the Commission's report which is now under the active consideration of the Government will give proper scope and open new channels for betterment of the status of the technicians.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirement over the next five years, in relation to the Colleges three main programme areas: (i) Staff Development and Training, (ii) Research and Development and (iii) Advisory and Resource Service.**

(i) We have in our country Technical Teachers Training College for the technical teachers required by the Polytechnic Institutes. There is no proper staff training (Instructor's) Centre for instructors required for Technical Training Centres and Vocational Training Institutes. There are staff Training Wing at the Technical Training Centre, Dacca and Chittagong but these wings are rather used as refresher course of training and, therefore, these two Training Centres should be properly staffed and re-organised with training materials preparation unit added to these two Training Centres to cater the needs of all the Technical and Vocational Training Centres in Bangladesh. The Colombo Plan Staff College for Technician Education could play a great role by providing training to our existing staff by sending their staff over here for certain periods to re-organise the staff training wing and also by providing staff and equipment for training materials preparation unit.

(ii) Research and development is very essential and the Colombo Plan Staff College may help by providing experienced staff to training our staff here for research and development work. Some staff from here may be sent for the purpose to receive the training at the Colombo Plan Staff College and for which adequate fellowship may be given.

(iii) The services of one or two staff from Colombo Plan Staff College may be made available here to assist re-organisation of advisory and research work.

9. **What steps could be taken to promote the expansion of intra-regional training.**

The exchange of teachers and reservation of some seats in the Technical Training Institutes of this region should be made particularly for those courses which are non-existent in some countries. Provision may be made for exchange of ideas and views for the improvement of the Technical Education amongst the member countries of the region. The exchange of teachers will also promote understanding and co-operation amongst the member countries. The exchange of students may create some language problem but that could be overcome by giving six (6) months extra language course to participants.

FIJI

1. **What are the objectives of the system of technical education in your country?**

The objective is to train students to craft, technician and higher technician (Sub-professional) levels. At present Fiji faces a shortage of skills for development. For instance, the present shortage of building and construction supervisors is resulting in a low level of work organisation which depresses productivity. The shortage of electrical workers would, if the regulations were strictly enforced, bring about a standstill in the installation of electrical equipment. And the shortage of technicians is depressing the productivity of professionals. The objective, therefore, is to make provision for a full range of tertiary level technician education for craftsmen, technicians and higher technicians.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

The Derrick Technical Institute was established in 1963. There has been dramatic growth since 1967 when technician diploma courses began to develop in addition to trade courses. From 1974 onwards, technician courses in mechanical, electrical and telecommunication engineering developed. Derrick Technical Institute phase III expansion is now almost in the pipeline. This, when completed, should result in approximately 50 percent increase in facilities. The satellite institute at Ba is in an advanced planning stage and other centres of technician education are envisaged at a later stage. The Fiji National Training Council has the mandate to review all training and make recommendations for the future in consultation with the Ministry of Education, Youth and Sport.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technicians?**

Generally speaking, technicians in Fiji do enjoy a status commensurate with the important work they do. It must be noted that technicians are few in number in Fiji and we are not sophisticated enough to have professional bodies for technicians as such. We believe that the Fiji Institution of Engineers have been asked to examine the feasibility of establishing some kind of a professional body for technicians.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

We already have technician courses and students can either concurrently or subsequently enter for higher overseas qualifications mainly by private study or by proceeding overseas for further study. Higher level technician courses are expected to develop in the next 4-years development phase (1975-1978). (Higner Technician Courses overseas have been used up to now). No part-time or correspondence courses exist but part-time and block-release or short courses will we hope develop in the 1975-1978 period. There are part-time classes at present for post-trade that is, advanced craft.

5. **Is any research being undertaken in technician education? If so, name the institution in which this is being done.**

No research is being undertaken at present but the new Unesco project just initiated may do some research and render development advice.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

The results of present manpower surveys are far too vague to be of value inthe context of this questionnaire. There is need for a more objective manpower needs survey:

(*a*) by categories;

(*b*) desirable content and form of technician training to meet the needs of Fiji;

(*c*) best form and content of staff development and training.

It would also be worthwhile investigating the possibility of more regional co-operation and setting up of specialised faculties/schools in different islands.

7. **Does the technical education system provide scope for innovation?**

Yes—e.g.

(1) New phase III plans will make Derrick Technical Institute very flexible in terms of possible changes with probable Fiji National Training Council/Derrick Technical Institute co-ordinated schemes.

(2) Labour/Education representation on various working parties under industrial training boards. We believe that these will enhance both craft and technician education training in the future.

8. **Describe the ways in which the resourees and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirements over the next five years in relation to the college's three main programme areas;**

(1) Staff development and training;

(2) Research and development; and

(3) Advisory and research service.

There is a drive at present towards localisation and Derrick Technical Institute teaching staff could benefit from

(*a*) Staff development training,

(*b*) Advisory and resource service—see also answers to questions 5 and 6 above.

At present we receive little or no information on the functions and plans of the Colombo Plan Staff College—greater liaison would be useful. More information in the form of bulletins, etc., would be very welcome.

9. **What steps could be taken to promote the expansion of intra-regional training?**

To enable neighbouring islands to utilise our facilities at Derrick Technical Institute adequately, more residential/hostel facilities are a pressing need. Also closer links between the Ministries of Education and Labour would be beneficial. It may be a good idea to organise a conference like this for the South Pacific.

INDIA

The Objectives of the System of Technical Education

The widening frontiers of knowledge have given special tools for progress to mankind. Even as in developed nations technology has been realised to be one of the major inputs to the economic system, the primary objective of developing countries is to achieve within a measurable period of time economic progress so as to raise their standard of living by using science and technology. This implies the transformation from a traditional economy to an economy based on technology. The modern technological society cannot be sustained without trained personnel who are also creative and possess an inquisitive mind. The important functions, therefore, of institutions offering facilities for technical education is to build up a reservoir of such intellectual human capital. In addition to the normal programmes of teaching and research, the technical institutions are required to involve themselves with the industry and other employers to have a meaningful relationship with the employingagencies. Only thus can the requirements of the changing economic challenges be met effectively to mutual advantage for the final attainment of the objective of rise in standards of the country. This has been, in main, the objective of the Indian system of technical education also so that the stock of technical manpower that is created is able to directly contribute to the development of the country.

Measures taken in recent years to make technical education responsive to the needs of the country

The development of technical education in India has been quite considerable over the last three decades. With the plans for development of technical education starting by the time of the Post (2nd World) War Reconstruction, there has been both quantitative and qualitative improvement in the system of technical education in the country. While at the beginning of this period nearly three decades ago, there were only half a dozen institutions all over the country offering graduate courses and about three dozen, offering technician courses with a total admission capacity of about 3,000 students per year, today there are more than 100 institutions offering graduate and post-graduate courses with a number of higher technological institutions catering for specialised research and there are about 300 diploma institutions offering technician courses, with a total annual intake of about 65,000. India has a federal structure with 21 States and 9 Union Territories and education is primarily the responsibility of these State Administrations. But the Federal (Union) Government is concerned with the co-ordination of educational facilities, determination of standards of higher education, scientific and technical education and research. The obligations of the Union Government are discharged by the Union Ministry of Education with the assistance of statutory agencies like the University Grants Commission and advisory bodies like the All India Council for Technical Education. The All India Council for Technical Education with the Union Minister of Education as the Chairman consists of representatives of all the State Governments and academic and professional bodies concerned and has its own specialised agencies such as the Board of Post Graduate Studies, Boards of Studies in Engineering, etc. the Board of Technician Education and the Board of Management Education who render advice to the All India Council concerning problems in their respective areas. In all these bodies, representatives of the industry and other employing agencies as also the professional bodies like the Institution of Engineers, etc., are involved so that there is a continuous appraisal of the needs of the various sectors of development in the country so that the system of technical education can be responsive to the needs of the country as a whole.

Similarly the National Council for Training Vocational Trades in the Ministry of Labour is able to bring to bear on all the schemes of training of craftsmen etc., the continuing needs of the employing agencies in the various sectors. Training in industry and other professional sectors is organised by statutory regulations of the Apprentices Act which require a certain percentage of training places to be made available to the technical institutions by industry. The scope of the Apprentices Act has been recently enlarged to include graduates and diploma holders in technical education also.

Status of Technicians

Technicians occupy a middle level between craftsmen and Engineering Technologist. The image of the technician and consequently the status in society of the technician, therefore, largely depends upon the responsibility accorded to this middle level functionary. It should also be remembered that in developing countries where the job requirements are still not completely "stabilised" the various categories of people to be employed to a great extent denote the social strata to which the person belongs, however unwittingly this might come about. Again realisation that technician education is different from the education of a technologist but not particularly inferior, is yet to come about. There are many factors which have no particular bearing on the capacity or the competence of the aspirant to the technician course who joins the same. These are the economics of the problem in that technician course as a whole is relatively less expensive than the corresponding graduate course for the student; the admission requirement may be much less; the period of study is less than that for a graduate course and so on. If therefore, the image and consequently the status of the technician has to be improved, naturally these inhibiting factors also have to be looked into and remedial measures taken. Only then to a greater extent, the technician will be able to stand on his own. The problem of employment of the technician also counts. By and large, the present day employer is often not too discriminatory in his need for a graduate or a technician and for the sake of "prestige" he may employ a graduate or for the sake of "economy", he may employ a technician to do the same job. Unless the employer also is sufficiently well informed as to understand the importance of employing the right type of person taking into account the specific job requirement, the anomalies of under-employment and mal-employment will continue to contribute to the diminishing status of the technician.

By the very nature of the problem, therefore, the improvement of the status of the technician is a gradual process and has to be tackled at the various levels and from the various angles indicated in the preceding paragraphs. Attempts are being made in India to improve the situation by identifying the problems involved and in taking these issues at various forums with the people concerned. The Government of India appointed a couple of years ago a Special Committee on the Reorganisation and Development of Polytechnic Education (Technician Education) in India. Among others, the Committee recommended that there should be a rationalisation of the manpower structure and a clearer identification of technician functions in industry and commerce and the technicians must be accorded a recognisable career structure adequately reflecting the importance of their position. The Committee has suggested various measures in support of this recommendation and the same are being pursued by the Union Government in consultation with the concerned interest.

Facilities for Part-time Correspondence Courses for Working Technicians

The need for the part-time courses for working technicians has been recognised for quite sometime and such courses are being organised in many Centres where sufficient demand for such courses exists. Faculty for the courses is also fully drawn from the neighbouring industry where these technicians are employed.

The organisation of Correspondence Courses requires a greater preparation in terms of instructional material, supervising faculty, etc., and this is being considered. However, facilities do exist for the working technicians to take up courses offered by professional institutions such as the Institution of Engineers and also certain Universities where short-term condensed courses are offered specially designed for the working technicians.

Research in Technician Education

While during the earlier years, the emphasis was on provision of adequate facilities for those aspiring for technological education including technician education, once the planned quantitative expansion has taken place, attention is now being given to the qualitative aspect of consolidation and development of the facilities in the institutions. It is at this stage, emphasis is being increasingly placed on Research in the area of Technician Education. Even though sporadic research attempts might be said to be noticed in various State Departments of Technical Education through their different agencies, organised research programmes are in evidence in some of the well-known industrial groups such as the Bharat Heavy Electricals, Hindustan Machine Tools and the Technical Education agencies such as the Technical Teachers' Training Institutes set up by the Government of India for training of Polytechnic teachers at four Centres in the country i.e. at Bhopal, Chandigarh, Calcutta and Madras. Areas such as Faculty and Curriculum Development, preparation of Instruction Manuals, Programmed Learning, Educational Administration, Cost-benefit Analysis, Activity Analysis, etc. are being taken up for investigation.

Important Technician Education problems in which research could usefully be undertaken

There is a wide range of problems in the field of Technician Education where it is possible to undertake investigation and research. The various components of the Technician Education System, i.e. physical facilities at the centres of technician education, the faculty, the students, and finally the employing agencies of the products of these centres, all these are areas where problems abound for specific investigation and research.

As far as the students are concerned, matters concerning the entry requirements the standards of inputs, admission pattern and regulations, basis of selection and admission tests, including aptitude screening, etc., social 'economic background of the input to improvise better the environment in the centre, are some of the pressing issues which have to be looked into.

The quick expansion (and sometimes considerations other than academic) leading to starting of a large number of centres for training of technicians results often in the facilities available (such as adequate accommodation for instruction and other purposes, equipment in laboratories and workshops and the libraries) to be inadequate and inappropriate. These have to be adequately provided for, for varying needs of instruction.

Again, expansion gives rise to problems of inadequately trained faculty which has to be geared up to meet the challenges of the tasks. Faculty development programmes at various levels and with different mix have to be provided for. The attendant problems of Curriculum Development, Instructional Material etc., have to be examined in detail and the Faculty trained in this process.

Finally, the problems of identification of the needs of the employer and relating it to the preparation of the product of the institution, involving the industry in the activities of the institutions for better preparation and subsequent utilisation of the product including system of final assessment and evaluation, all these lend themselves with their multi-facet complexities and dimensions to investigative research.

Scope for Innovation in the Technical Education System

Each country has its own background of development, history of planning and extent situation and hence there is always scope for innovation. Moreover experience shows that wherever research is planned to lead to new or improved products, it is most likely to yield more meaningful results if it is done in the vicinity of the point of application. Hence the best results of any investigation and research in the problems of a particular country naturally can be expected only when innovative research is undertaken in that country itself. Any imported technology or system will not give the best benefits since even by the time the imported technology is adopted to the indigenous requirements, it would have become less effective, if not obsolete. Further, the strides in technological development that have taken place in the decades in the advanced countries have to be telescoped comparatively into a few years in the developing countries and for this reason for the development of indigenous technology, innovations in the field of technical education are extremely important.

Utilisation of the Resources and Facilities of the Colombo Plan Staff College for Technician Education

The three main areas indicated, i.e. Staff Development and Training, Research and Development and Advisory and Resource Service are important and quite comprehensive and hence useful for the requirements of the development of technician education programmes. However, there are other areas also in which the Staff College can help all the countries.

While programmes of general utility might be mounted at the Staff College to be able to cater to all countries, specific reequirements in areas of Administration, Finance, Planning, Assessment Training and Utilisation of Manpower etc., depending upon the state of development of the individual country, will be more useful. No doubt, this requires more detailed study of the country's background and set up but for that very reason, even from the purely academic point of view such programmes will be very helpful as case studies not only to that country but also to others, so that such problems elsewhere may, with slight modifications, may be tackled on similar lines. Thus the state of industrial and economic development of each country might require courses of a particular nature to be emphasised. Here again, after identification and planning of the courses in consultation with their respective industrial and employing agencies will be a task to which the Staff College can address itself with predictable amount of success. It might be necessary for the Staff College, in course of time, to have a core Faculty well trained for the various tasks and these could be deputed to assist the participating countries for the various programmes.

Even though there is bound to be difference in approach to the concepts of the standards of education from one country to another, depending upon the needs of developing technology, the Staff College will be able to assist the countries in the region in developing and attaining specific required standards of technical education in general and technician education in particular. The participating countries might, with great benefit, like to understand and reach a uniformally high standard of technician education. Not only for setting the guidelines but also for laying out programmes and procedures for assessment and awards, etc., acceptable throughout the region, the Staff College might work out specific projects.

An important task for the Staff College also will be in the area of production of inexpensive text-books for the countries in the region. This can be attempted in two ways: (a) by translation into the (specific) country's languages the standard works in the subject fields and (b) by providing the expertise, support and encouragement for production of indigenous text-books in the local languages. This is a stupendous but very important task which will pay good dividends and has to be taken up at the earliest.

The changing needs of developing technology places a great burden on the physical facilities such as equipment to be made available in the technical institutions. Particularly at the technician level, where better appreciation of practical processes is most essential, the conceptual understanding of the principles involved cannot be belittled. At the same time, the expense involved in continually re-equipping or adding on to the stock of equipment in the institutions perhaps may forbid any effective updating of training. It is in this context that the institutions have to think in terms of simulating industrial processes and practices to the extent possible in their own premises with inexpensive gadgets. In this field the Staff College can help greatly by training the countries' leaders for such innovation by the Staff College developing a Centre for Education Technology for this purpose.

Expansion of Intra-Regional Training

Facilities for training in each country have to an extent been identified by the participating countries. However, a more systematised and methodical assessment of the available facilities in each country has to be made so that a compendium of such facilities periodically updated will help in the countries choosing the facilities of their choice from any other area either through the Staff College or through bilateral arrangements.

On the lines of the I.A.E.S.T.E. (International Association for the Exchange of Students for Technical Experience) more student exchange programmes of duration of 2-3 months might be arranged in member countries' industries and technical institutions for selected students during the course of their studies. Details of such programmes regarding international travel, stipend during the stay in another country, etc., can be worked out.

This is the International Women's Year and it may not be out of place here to mention that in developing countries where the women's population is also considerable, the responsibilities for economic development have necessarily to be shared by women also. While special attempts to improve literacy and spread of education among women in these countries are being made, specific area of technology where the contribution of women has been noted to be significant and can be considerable, has also to be taken into account. For various reason, it might be necessary that technical education is imparted to this section of society, i.e. women of the developing countries with a planned programme. India has some experience in this direction in that there are more than 20 technician institutions (Women's Polytechnics) specially catering to ladies who opt for different areas of technical education either with intentions of making it a career or otherwise. These Women's Polytechnics now very popular in the country have established themselves for more than a decade now in offering courses of special interest to ladies such as technician courses in Secretarial Practice, Electronics and Communication Engineering, Architecture, Garment Making and Costume Design, Institutional Management, Interior Decoration, Library Science and Documentation, Costmetology, etc. Facilities for training of leaders of lady technicians from other countries in the region will be available at these Women's Polytechnics in India.

The Staff College can bring out a brochure about the facilities available in the region in general and also publish periodically a journal disseminating relevant information to all the member countries.

In conclusion it may be said that the role of the Staff College could be increasingly enlarged and made effective by the participating countries' efforts to use the College in a larger measure for their various requirements.

The Ministry of Labour is involved in training of skilled and highly skilled workers. Some of the highly skilled workers while undergoing training in these institutes are upgraded to the level of technicians. A note on the programmes being conducted by the Ministry of Labour is attached.

TECHNICAL VOCATIONAL FACILITIES IN INDIA UNDER THE DIRECTORATE GENERAL OF EMPLOYMENT AND TRAINING, MINISTRY OF LABOUR, GOVERNMENT OF INDIA

General Information

A regular supply of skilled manpower at different levels is required by industry, Central and State Governments for the economic development and successful implementation of the Five-Year Plans. To achieve this object, Directorate General of Employment and Training in the Ministry of Labour have organised and are conducting a number of institutional, apprenticeship and advanced training programmes in the Country.

Training of Craftsmen in the Industrial Training Institute and Apprenticeship Training

Training is imparted in 32 Engineering and 22 non-engineering trades approved by the National Council for Training in Vocational Trades to young people within the age group of 15 to 25 years. For this purpose 357 Industrial Training Institutes with an overall capacity of 155,000 training places have been established in the various parts of the country. Period of training ranges from 1 year to 2 years. The Industrial Training Institutes are also used as Basic Training Centres for the Apprenticeship Training Programmes under the Apprentices Act 1961. The trades designated under the Apprentices Act follow our national classifications of occupations.

Craft Instructor Training

There are 7 Central Training Institutes for training of Instructors under the Directorate General of Employment and Training. These institutes conduct regular, refresher and retraining programmes for the Craft Instructors in various engineering and non-engineering trades. The Instructor trainees are deputed mostly by the various Industrial Training Institutes and Industrial Establishments in the country. Also, a number of foreign trainees have been trained in these Institutes. During the last 10 years these institutions have trained about 1,100 Craftsmen Instructors from Malaysia, UAR, Kenya, Uganda and other countries.

At the end of the last decade, it was realised that higher or advanced levels of skills were required by the industry both in public and private sectors for working on the more modern and highly specialised type of machine tools and equipment coming to be used extensively. To meet this need the following institutes have been established:

(i) **Advanced Training Institute—Madras**

The Advanced Training Institute, Madras, set up with assistance from the United Nations Development Programme impart training in Advanced Vocational Skills such as Tool Design, Tool and Die-Making, Heat Treatment, Metrology, Machine Tool Maintenance and Advanced Welding, etc.

(ii) **Foreman Training Institute—Bangalore**

The Foreman Training Institute, Bangalore imparts training not only in developing further skills, but also in managerial skills for first line supervisors.

(iii) **Central Staff Training & Research Institute—Calcutta**

The Central Staff Training and Research Institute set up at Calcutta with assistance from West Germany, is charged with the responsibility of conducting training programmes for those officers and staff of the Central State Governments and from Industry, who control, regulate and direct Vocational and Apprenticeship Training Programmes. This Institute is also involved in the Research Developmental activities in the field of Vocational Training.

(iv) **Advanced Training Institute in Electronics—Hyderabad**

The Advanced Training Institute in Electronics, Hyderabad has been set up last year to provide training at Cratfsmen and Technician level for the electronic personnel required in the country.

There are now proposals to increase the number of such institutes all over the country.

INDONESIA

1. **What are the objectives of the system of education in your country?**

   The objectives are to provide the trained and skilled technician in specific, quality and quantity which is relevant to the need of the national development in short, medium and long term.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

   Prepared the National Advisory Committee of Technical Education, arranging on intimate approach to the industrial community and technical manpower consumers, organized seminars, designed and establishing 8 pioneer projects of senior technical school and polytechnic institutes (long range programme) built and operating 5 Technical Training Centres, and starting to rehabilitate 80 Senior Technical Schools (software and hardware—medium range programme), continuously develop technician training programme and built technician training centres (short-medium and long range programme), and to support these programme about 1900 technical teachers have been upgraded and more of them also will be upgraded, publishing many technical books and other activities which support relevancies, effectivity and efficiency have been done.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technician?**

   We are still surveying about this. There is no separate technician's association but there is labour association (F.B.S.I.).

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

   This case has been designed by the Department of Manpower, Transmigration and Co-operation.

5. **Is any research being undertaken in technician education? If so, name the institutions in which this is being done.**

   Yes.

   The institutions are: the Directorate of Technical & Vocational Education and other units in the Department of Education and Culture, the Department of Manpower, Transmigration and Co-operation.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

   Quality improvements, problems of relevancy, efficiency and effectivities and to develop the training for technical teachers.

7. **Does the technical education system provide scope for innovation?**

   Yes.

Please see Appendix III also for an additional Paper on "The Influence of Technician Education on Economic Development, Both Long-Term and Short-Term in Indonesia", presented by delegates from Indonesia.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff-College for Technician Education could be utilized to meet your country's requirements over the next five years; in relation to the college's three main programme areas:**

   (i) Staff Development and Training;
   (ii) Research and Development; and
   (iii) Advisory and Resource Service.

   (i) To train senior administrators, regional inspectors of technical education, principals of Technical Schools.

   (ii) To assist the development of technical education, to make more relevant, more effective, more efficient and to improve the quality.

   (iii) To help developing innovative ideas on technical education, through sending experts, participating in seminars, teaching materials, etc.

9. **What steps could be taken to promote the expansion of intra-regional training ?**

   It is necessary to establish co-operation programme, to improve and develop technical education programme.

Additional answer to the questionnaire of the delegates from Indonesia .

Especially for the senior technical schools (pioneer projects), the objectives to be achieved are:

(1) to educate students to become "adults mature" of technical ability, with a pioneering spirit, contented in their work, able to process the ideas of technologists, supervise production processes, supervise and lead other technical workers in their chosen field;

(2) to increase its own efficiency so that the function of its schools as a human investment may be achieved;

(3) to develop each technical education campus as an integral part of the local community in accordance with the principle of life-long education.

The products of those schools are called: "TRADE TECHNICIANS".

IRAN

1. **What are the objectives of the system of Technical Education in your country?**

   Present technical education programmes under the Ministry of Education operate at several different levels.

   First, a programme at the lower secondary level (Grade 6, 7 and 8) for skilled workers.

   Second, a programme at the upper secondary level (Grade 9, 10, 11 and 12) for junior technicians.

   Third, a programme for senior technicians in post secondary level (Grade 13 and 14) Technical Institute, which are presently integrated with technical high-schools.

Fourth, a programme at the upper secondary level (Grade 9, 10, 11 and 12). Comprehensive schools which besides academic courses, offers elective courses in varied technical area.

The vocational training of skilled and semi-skilled workers is the responsibility of the Ministry of Labour and Social Affairs. The Ministry encourages technical apprentice training schemes through the special fund, so that by the end of the Fifth Plan some 29 industries will be subject to the apprentice training law.

The aim of the system is to train skilled manpower, including qualified technicians, engineers, administrators and particularly skilled workers, foremen and personnel at middle level for whom great need is felt in different areas due to the rapid changes of the country towards industrialization.

By the end of the Sixth Plan the educational capacity will be sufficient to train all the necessary skills. In order to achieve these objectives in Iran's Fifth Development Plan,[1] (March 73-March 78) some 500 technical and vocational units are expected to be established during the plan which will raise the capacity from the present 95,000 to 552,000 by the end of the Fifth Plan. As a result 72,000 senior technicians; 132,000 junior technicians; and 650,000 skilled and semi-skilled workers will be trained in the area of industry, agro-industry and services.

2. **What measures have been taken in recent years to make Technical Education Responsive to the needs of the country?**

   (*a*) Increasing the capacity of present vocational and technical schools and centres.

   (*b*) Establishing new vocational and technical school and centres.

   (*c*) Diversifying the course subject of the vocational and technical units to cover industry, agriculture and services. The contents and methods of the entire technical system is being changed to response to the society need.

   (*d*) Establishing Institute of Technology for training senior technicians.

   (*e*) Establishing 'training fund' which has enabled the private sector to participate in manpower training. By the end of the Fifth Plan legislation pertaning to vocational training will apply to 29 basic industries.

   (*f*) Establishing the "Industrial Education Complex" which is responsible for training skilled workers, technician, and engineer with close cooperation and with the industries.

   (*g*) Establishing 'mobile vocational training units' to give short-term training.

   (*h*) The private industry is encouraged to establish training units adjacent to factories through long-term government loans and participate in training programmes through financial and legislative assistance.

   (*i*) Developing vocational guidance and counselling.

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[1] Annex 1.

3. **Do Technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for Technicians?**

The need for technical and vocational personnel in order to implement development programmes will increase considerably, so much so that for most specialized and skilled occupations there will be shortages.

The Fifth Plan investments are expected to generate 2.1 million new jobs. There is a short fall of about 700,000 in manpower supply which the shortage at technicianslevelwillbeabout 41,000 persons.

The above statement shows the country problems in manpower and at the same time can reflect the technicians status in the country. Needless to say that technicians here enjoy work standards and conditions.

4. **What opportunities exist for the professional advancement of Technicians? Are there facilities for part-time and correspondence courses for working Technicians?**

All the technical high schools offer night class for those who work during the day. Most Institutes of Technology operates from 3.00 p.m. which enable the working technicians to attend the Institute to further study. Some colleges and university offer some night courses.

The "Industrial Education Complex" provide opportunity for working technicians to work and study one year (or two years) between.

Institute of Technology graduate can continue their study in technical college after 2 years working in their study area.

Free University is going to be established which will provide opportunity for all interested people to continue their study in individual basis.

Every year many technicians are sent abroad for further training and study.

5. **Is any research being undertaken in technician education? If so, name the Institutions in which this is being done.**

The Institute for Research and Planning in Science and Education, and the Ministry of Science and Higher Education carried many researches in the field of education and some in technical and vocational education. Some of the Institute's publications are available in English and can be obtained directly from there.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

(*a*) Curriculum Development.

(*b*) Instructor Training.

(*c*) Establishing a mechanism to create close co-operation between the schools and potential employers of the educational units graduate.

(*d*) Developing vocational guidance.

7. **Does the Technical Education system provide scope for innovation?**

The content and methods of the entire educational system is being restructured. Since the short-fall in manpower supply will not be filled by traditional methods many new ways and approaches are taking into account, and more flexibility will be introduced in technical and vocational schools to enable students to master new skills according to the changing needs of a developing country.

Rapid economic development of the country and the need of more skilled labour force facilitate the diffusion of innovation in the educational system.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirements over the next five years, in relation to the College's Three main programme areas: (i) Staff Development and Training; (ii) Research and Development and (iii) Advisory and Resource Services.**

Colombo Plan Staff College for Technician Education could be utilised in staff training in the college site by running courses in the country. Staff College can help in some educational project which carry by the government in the technician education field by offering resource service such as:

(*a*) Teacher Training;

(*b*) Educational facilities standards;

(*c*) Developing test;

(*e*) Developing and producing educational materials;

(*f*) On-the-job training.

9. **What steps could be taken to promote the expansion of intra-regional training?**

Some mechanism should be established to enable each member country to be aware about the training facilities which exist and can be utilised by other countries.

Iran's Fifth Development Plan (March 1973-March 1978) was approved by the two Houses of Parliament in February 1973. It called for total investments of 2,461 billion rials ($36.4 billion) during the five-year plan period. Of the total 1,549 billion rials ($22.9 billion) was to come from public sector and 912 billion rials ($13.5 billion) from private sector investment. The bulk of public sector investment would be financed by anticipated total oil revenues of about $24.6 billion in the Fifth Plan period.

Decisions taken by the Organisation of Petroleum Exporting Countries in October and December 1973, and subsequent developments in the international oil market had the effect of practically quadrupling Iran's per barrel oil revenues. As a result, revenue estimates from the oil sector in the Fifth Plan period were revised upward to a new figure of $93.2 billion.

The huge jump in oil income permitted a revision of all sectors of the Fifth Plan and much increased spending on economic development, social welfare, defence infra-structure and public administration. This revision took place in consultation between the Plan Organisation and the ministries in mid-1974.

The revised Fifth Plan, providing for a near doubling of investments, was approved in September at a Conference of Cabinet Ministers, Plan and Budget Organisation officials and other ranking members of the Government meeting under the Chairmanship of His Imperial Majesty. The revised Plan was submitted to parliament in December 1974.

Annex II

GENERAL INFORMATION ABOUT EDUCATION IN IRAN

In the academic year of 1972/1973 the total number of pupils and students enrolled in kindergartens, schools and colleges throughout the country was 5,808,544[1] of whom 468,374 students attended in Literacy Corps Schools and 157,948 students attended in night Secondary Schools.

In 1972 the allocated ordinary budget for the Ministry of Education amounted to 23,383,400,000 rials.[2] In addition, the expenditure by private schools, is estimated at Rls. One milliard Rials for elementary schools, 321 million Rls. for Guidance cycle Schools, and about 826 million for Secondary Schools.

Individual contributions, estimated a sum exceeding Rls. 706 million in either real estate or cash, were also made to the Ministry of Education during that year.

VOCATIONAL EDUCATION

In the academic year of 1972/1973 there were 66 vocational, 129 technical, 39 commercial, and banking, 34 secretarial and 9 industrial chemistry schools in operation (under the supervision of the Ministry of Education) with a total number of 56,745 students (46,508 boys and 10,237 girls). Out of this number only 64 were private.

BUDGET

In 1972 the allocated ordinary budget for technical and vocational education amounted to Rls. 803,528,000 which was 3.5 percent of the total budget of the Ministry of Education, including the funds devoted for vocational education for boys and girls.

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[1] Educational Statistics, 1974, Ministry of Education.

[2] Rials 67.75=$1.

Annex III

EDUCATIONAL TARGETS/5TH PLAN

(in 1,000 persons)

Level	*Numbers/end 4th Plan*	*Numbers/end 5th Plan*	*Increase during 5th Plan*	*% Increase*
Kindergarten	22	580	558	2,536
Primary (1)	3,446	5,500	2,054	60
Guidance cycle (2)	571	1,670	1,099	192
Secondary (3)	617	904	287	46
Technical (4)	64	331	267	417
Higher education	115	190	75	65
Vocational (5)	31	229	198	640
Literacy (aged 10-44)	8,250	15,600	7,350	89

1. Grades 1 through 5
2. Grades 6 through 8
3. Grades 9 through 12
4. On-the-job training by ministries, and training of primary school teachers.
5. Figures reflect the annual capacity of vocational training centres for skilled and semi-skilled workers.

Annex IV

DISTRIBUTION OF STUDENTS BY FIELDS (5TH PLAN)

	End of 4th Plan		*5th Plan Target*	
	Number	*percent*	*Number*	*percent*
Humanities	15,361	13.4	19,000	10.0
Teacher training and Education*	23,394	20.3	37,300	19.5
Fine arts	3,200	2.8	5,300	2.8
Law	2,300	2.0	3,400	1.8
Social sciences	24,870	21.6	42,000	22.2
Natural sciences and mathematics	11,759	10.2	20,900	11.0
Engineering	18,116	15.8	34,800	18.3
Medicine	11,300	9.8	19,000	10.0
Agriculture	4,700	4.1	8,300	4.4
Total	115,000	100	190,000	100

* During the 5th Plan 5,000 of this group will major in education and the rest in specialised areas.

TECHNICAL AND VOCATIONAL TRAINING (5TH PLAN)

(Persons)

	Capacity/end 4th Plan	*Capacity/end 5th Plan*	*Total number of trainees during the 5th Plan*
Post-diploma technicians in agro-industry and services (1) and (2)	24,760	42,500	72,700
Middle-level technicians in agro-industry and services (3)	64,000	331,000	132,100
Pre-and on-the-job trainees (excluding education cadre)	—	—	141,000
Training of skilled and semi-skilled labour in short courses (4)	31,050	229,000	650,000

(1) Students in post-diploma courses are reflected in higher education figures.

(2) Including 2-year teacher-training programmes (post-diploma level).

(3) Including primary school teacher-training (diploma level).

(4) Including on-the-job orientation training of less than one month.

Annex VI

FIXED INVESTMENT IN EDUCATION (5TH PLAN)

(billion rials)

	Public sector	*Private sector*	*Grand total*
Kindergarten	2.90	0.30	3.20
Primary	21.70	0.60	22.30
Adult literacy	—	—	—
Guidance cycle	15.8	0.40	16.20
Secondary	9.50	1.00	10.50
Vocational	21.40	1.00	22.40
Higher education	29.00	1.50	30.50
University research	0.50	—	0.50
Teacher training	17.00	—	17.00
Teaching aids	5.00	—	5.00
Sports in schools	4.00	—	4.00
Research and evaluation	—	—	—
Administration	—	—	—
Total	126.77	4.80	121.57

Annex VII

DISTRIBUTION OF NEW EMPLOYMENT OPPORTUNITIES BY ECONOMIC SECTORS (5TH PLAN)

(in 1,000 persons)

Economic Sector	*Persons*	*Percent*
Agriculture	129,600	6.1
Industries and mines	846,000	40.0
Oil and gas	12,500	0.6
Water and electricity	44,000	2.2
Construction	528,000	25.0
Services	551,900	26.1
Total	2,112,000	100.00

Annex VIII

SUPPLY, DEMAND AND SHORTAGE OF MANPOWER (5TH PLAN)

(in 1,000 persons)

Major Fields	*Demand*	*Supply*	*Shortage*
Engineers	36.4	20.3	16.1
Medical cadre	44.1	21.5	22.6
Educational cadre	237.4	230.0	57.4
Miscellaneous	279.5	266.0	13.5
Technicians	116.6	75.0	41.6
Skilled and semi-skilled workers	810.0	250.0	560.0
Unskilled workers	538.0	528.0	10.0
Total	2,112.0	1,390.8	721.2

Annex IX

SUPPLY, DEMAND AND SHORTAGE OF MANPOWER
(5TH PLAN)

(in 1,000 persons)

Engineers	*Demand*	*Supply*	*Shortage*
Architects, civil	7.8	4.0	3.8
Electric and electronics	5.5	2.8	2.7
Mechanical	6.9	4.2	2.7
Chemical, mining and metallergy	2.0	1.0	1.0
Others	14.2	8.3	5.9
Medical Cadres			
Physicians	8.5	7.2	1.3
Others	35.6	14.3	21.3
Educational Cadres	287.4	230.0	57.4
Management Level	22.5	21.0	1.5
Technicians	116.6	75.0	41.6
Other Technical and Skilled Cadres	8.0	4.0	4.0
Administrative and Clerical Sales	185	185	—
Miners	23.0	15.0	8.0
Transport	41.0	41.0	—
Skilled and Semi-skilled Workers	520	230	290
Skilled Construction Workers	290	20.0	270.0
Unskilled Workers	538	528	10.0
Total	2,112.0	1,390.8	721.2

REPUBLIC OF KOREA

1. Technical Education in Korea

(1) *Objectives of the technical education system*

The articles of the laws and regulations related to the aims of vocational high schools and colleges state general aims and objectives of technical education. An Ordinance of the Ministry of Education describes the objectives of technical high schools as follows:

(1) To raise the capability to be a technician or craftsman by providing basic knowledge and practical skills.

(2) To make one acquire the knowledges necessary for skilled manpower and to cultivate the attitudes required for improving and developing technical skills.

(3) To cultivate co-operative attitudes conducive to a fluent democratic country by making the students understand the relationship between industry and national economy, and by fostering the proper self-consciousness as a technician or a craftsman.

The junior technical colleges, graduates of which are qualified to be technicians, aims at making one acquire professional knowledges and industrial skills, and at producing senior technical manpower required for industrial development.

(2) *Recent changes in technical education*

Several measures have been taken in recent years to make technical education responsive to the developmental needs of the country.

First of all, there is a mounting demand for skilled manpower required for heavy and chemical industries, which are the strategic leading sector for investment of the Third Five-Year Economic Development Plan (1972-1976). Thus the government has made intensive efforts to expand technical education programmes within the formal education system as well as training programmes within industry and in various vocational training centres.

In relation to this, the Government has operated a rating system for technical skills. Under the skill rating system, the winners of technical contest held among vocational school students receive full scholarships and get proper job-placements after graduation. The system intends to insure the advantages of students with qualified skills and accordingly to encourage the development of technical skills.

Technical education cannot be effectively performed without actual experiment and practice in workshops. A huge amount of financial resources has been invested to alleviate the shortage of facilities and equipments for practice in vocational schools. In addition, according to a special law, the Government is responsible for providing more than half of the expenses for workshop operation in vocational schools.

Junior technical colleges have run five-year courses corresponding to grades 10-14 and are expected to provide the main supply of properly trained technicians. However, the institutions were suffered from many drop outs during the schooling period and the supply capacity of skilled technicians falls much short of their demand. Since 1973, therefore, reorganization has been undertaken from the present five-year junior technical colleges into the two-year courses after the high school graduation.

2. Status of technicians

(1) *Demand and supply*

According to the Government's projection, the demand for technicians will increase rapidly from 57.9 thousand in 1970 to 96.2 thousand in 1976. But the present supply capacity from both the junior colleges of natural science and the junior technical colleges is far behind the demand.

Demand and Supply of Technicians

		1972	1973	1974	1975	1976
Demand		68.9	75.2	81.7	88.7	96.2
Supply	Now employed	61.4	66.9	73.0	79.3	86.0
	Present capacity	4.4	3.2	3.3	3.8	3.8
	Expansion of Tr. Tech. Colleges	—	0.9	1.8	2.3	2.8
	Vocational Training	0.1	0.4	0.7	1.1	1.1
	Transfer from Colleges and Univ.	3.0	3.8	2.9	2.2	.25

Currently there are three sources of supply for technician level of manpower: (i) Transfer from university graduates, (ii) Graduates of Junior Technical Colleges, (iii) Promotion of craftsmen and skilled workers.

(2) *Social status of technicians*

In Korea, there still exists a cultural climate neglecting blue-collar jobs. For example, the most of prominent students tend to apply for academic high schools rather than vocational high schools. This attitude or values of the people might be a factor which prevents technicians from enjoying a status commensurate with their important role. It cannot be said, therefore, that satisfactory incentives are given them from either social or economic viewpoint.

However, the social status of technicians seems to be gradually enhancing. Their wage level has improved, and the Government adopted a system whereby certain categories of employers must employ a certain percentage of certified technicians. Specified works closely related to public health and other important services have to be performed exclusively by technicians with proper certificates. The newly adopted technical certification system, which aims to give equal certificate to the ones with equal qualification, is expected to contribute a great deal for improving socio-economic status of technical workers.

The objectives of the Law of Technical Qualification are as follows:

(1) To establish an evaluation system for the level of technical skills;

(2) To guarantee the advantages of the workers with proper technical qualification;

(3) To induce an improvement of the technical education;

(4) To systematize the various technical certificates which would be conflicting at present.

(3) *Opportunities for professional advancement*

A number of technicians missed the opportunities to get formal education with proper certificates. In 1972, the Korean Correspondence College was established for the purpose of providing chances to undergo selected higher education programmes to those who lost an opportunity for college education because of economic reasons or geographical, disadvantages. Five courses at junior college level have been offered for 24,000 students. The correspondence programme is expected to provide many technicians with good opportunities for professional advancement. The government also operates high school programmes of broadcasting and correspondence throughout the country in order to offer educational opportunities for the workers who could not enter a high school.

The school-industry co-operation system, which has been gradually expanded in recent years, also offers different types of advanced training programmes. Selected vocational schools provide in-service training for eligible technicians. The System encourages colleges of engineering and enterprises to share their facilities and technical resources, expanding short-term engineering courses based on joint co-operation.

Toward the Improvement of Technician Education

(1) *Major problems and research needs*

One of the basic problems has been the lack of fundamental philosophy and policy on occupational training, coupled with a confusion of strategies between the educational goals and the aims of vocational training. The problem is serious mainly due to little co-ordination between technician education and industrial needs. Basic stands of technician education should be clarified so that it can be effectively incorporated with various training programmes in producing able technicians. This is one of the areas on which research could usefully be undertaken. Subsequent research topics would be "job-analysis of the technicians by industry and by occupation", "Functional differentiation between technician education and training", and "industry-education corporation system for technician training".

Another problem concerns with distribution of outputs from the technician education system. It is frequently pointed out that co-relationship is low between the educational backgrounds of the graduates and their occupations. For example, a graduate who majored engineering course tends to get a clerical job willingly. It means that the educational outputs are not fully exploited from the viewpoint of the society and also that the present system makes waste of a part of educational investment. The low co-relationship between education and occupation could be attributed to the lack of validity in the contents of technician education and the inadequate function of the manpower distribution mechanism at technician level. Several areas of useful research may be "a follow-up study of the graduates from the junior technical colleges", a content analysis of the junior colleges' curriculum", and "measures for strengthening vocational guidance and proper job-placement".

Another lingering problem with technician education seems to be shortage of facilities for practice and equipments for experiment. It is a common problem to all vocational schools as well as to the junior technical colleges. Importance of experiment and practice cannot be overemphasized in technical education. Considering the limit of financial resources for procuring the facilities and equipments, efforts have been made to explore possible measures for supplementing the shortage of facilities. Further research would be helpful on "full utilization of the existing facilities and equipments", and "industry-school corporation devices in terms of facility utilization".

LAOS

1. **What are the objectives of the system of Technical Education in your country ?**

   To meet needs of the country especially:

   (*a*) In middle class technicians.

   (*b*) To take the place left vacant by foreign technicians.

   (*c*) Laos is an underpopulated country and economic development requires lot of machines which must be operated by skilled technicians.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country ?**

   Measures have been taken by:

   (*a*) The ministry of national education for:

   — Extension of existing technical schools.

   — Setting up new training centres.

   (*b*) Other ministries in their respective fields: ministries of public works telecommunication, economy, etc.

3. **Do technicians enjoy a status commensurate with the important work they do ? If not, what measures are planned to improve their status ? Are there separate professional bodies for Technicians ?**

   — No.

   — Manpower regulations should be enforced and put into application.

   — No

4. **What opportunities exist for the professional advancement of Technicians ? Are there facilities for part-time and correspondence courses for working technicians ?**

   — Social promotion and further training abroad.

   — No.

5. **Is any research being undertaken in technician education ? If so, name the Institutions in which this is being done.**

   — No.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

- Training programmes which should match the actual requirement of the employment.
- Employment.
- Involvement of industries in technician education.

7. **Does the technical education system provide scope for innovation ?**

- No.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirements over the next five years, in relation to the college's three main programme areas: (i) Staff Development and Training: (ii) Research and Development and (iii) Advisory and Resource service.**

(*a*) *Staff Development and Training*

- Extension of existing facilities to train staff in quantity and quality commensurate with the needs.
- Fellowship abroad.

(*b*) *Research and Development*

- Involvement of industries in technician education.
- Manpower projection.

(*c*) *Advisory and Research Service*

- To advise in the approach for reaching a specific goal.

9. **What steps could be taken to promote the expansion of intra-regional training?**

- Better co-ordination among member countries.
- Mutual assistance under the Colombo Plan.

MALAYSIA

1. **What are the objectives of the system of technical education in your country?**

(*a*) To develop technical education an integral part of the overall system of education so as to promote the individual's appreciation of industrial activities as related to society.

(*b*) To provide basic skills for employment and to provide opportunities for further studies in higher technical institutions.

(*c*) To impress the student with the concept of the dignity of productive work.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

There is a rapid development and expansion in technical education at all levels:

(*a*) Students are encouraged to study technical subject from the age of twelve plus.

(*b*) More technical and vocational schools are being constructed.

(*c*) Greater opportunities for tertiary level of technical education are provided locally.

(*d*) Participation of the private sector is obtained to ensure that training is in keeping with the needs of industry.

(*e*) Manpower studies are being made to ensure that the technical education is in keeping with national requirements.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technicians?**

Technicians in this country are paid and treated fairly well. However, there is an urgent need for changes in society's attitudes to them. There is no separate professional body for technicians.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

Technicians who wish to improve themselves may do so by attending night/correspondence/day schools and taking exams held by the various educational institutions or professional bodies or departments.

5. **Is any research being undertaken in technician education? If so, name the institutions in which this is being done.**

There has not been much research done in the field of technician education. However, since 1965 there has been studies/research in the type of technicians required and the type of training to be done. This research though to date limited in nature is done by the Economic Planning Unit in the Prime Minister's Department in co-operation with the various training institutions. It is expected that in future more work in this field will be carried out by the Polytechnics, the University of Technology and the National Industrial Training and Trade Certification Board.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

It is felt that the following problem areas need to be looked into:

(*a*) How to ensure that the technician training while providing enough in depth study in a particular field is also broad based enough to allow mobility from one field to another, as we do not have enough and accurate data on manpower needs.

(*b*) How to get more industrial sector participation for on-the-job training, and to make the curriculum relevant to the needs of industry.

7. **Does the technical education system provide scope for innovation?**

At this juncture the scope for innovations in technical education is limited due to shortage of teaching staff.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirements over the next five years, in relation to the College's three main programme areas: (i) Staff Development and Training; (ii) Research and Development and (iii) Advisory and Resource Service.**

   (*a*) Teaching staff at the Polytechnics and other institutions could attend courses and seminars to acquaint themselves with the latest development and techniques that have taken place.

   (*b*) The Staff College research personnel could co-operate with us to do research work on specific problem areas as mentioned in (6) above.

   (*c*) The institutions could use the Staff College Advisory services in the planning of new courses and improving and updating teaching by making use of the resource material available.

9. **What steps could be taken to promote the expansion of intra-regional training?**

   Specialisation of a particular country should be identified and information on this be widely disseminated throughout the region. Scholarships should be provided for other countries to send trainees in that field of specialisation.

NEPAL

1. **What are the objectives of the system of technical education in your country?**

   Nepal feels that the perpetual dependence on technical assistance to meet the technical manpower requirement and the reliance on foreign personnel to execute various development projects is not desirable for the sustained growth of the country. Though the technical assistance programme under the Colombo Plan, though has been very helpful to meet the requirement of the technical personnel and has also added an additional thrust in her development process, she feels that the institutional infrastructure facilities and research capabilities should be developed within the country.

   Nepal, on her part, is trying her best to create institutional base to produce mid-level and basic-level technical manpower through the implementation of the National Education System Plan. The present educational organisation is geared to achieve the following objectives :

   (*a*) Secondary education is extended from class 8 to 10 and its aim is to produce skilled workers by imparting vocational training.

   (*b*) First level of higher education is the certificate level and its aim is to produce low-level technical manpower.

   (*c*) The second level of higher education is the diploma level and its aim is to produce high level technical manpower.

   (*d*) The third level of higher education is the degree level and its aim is to produce high level technical manpower.

   So the basic objective of the present education system is to supply trained manpower for national development and to generate a deeper faith in the national heritage and the Panchayat system. To this end, vocational education has received special emphasis and qualitative improvement is synchronised with the quantitative growth. Moreover, the objective of the technical education system is to develop the present technical and vocational education institutes as degree level technical institution once adequate workshop, laboratory facilities and other necessary institutional infrastructure are developed.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country**

The previous education system in Nepal put almost exclusive stress on general education. The level of education was not complete in itself in that it only worked as a step toward higher education. Moreover, the previous system was not designed to meet the specific manpower requirements of the country.

In view of the ineffectiveness of the previous education system, Nepal has implemented the National Education System Plan. This Five-Year Education Plan is primarily geared towards counter-acting the elitist bias of the previous education system and is linked up more effectively to productive purposes. So the major thrust in the National Education System Plan is towards producing technicians, skilled and semi-skilled personnel to meet the manpower requirements of the national plan through the spread of scientific and technical education. Under the circumstances, the National Education System Plan emphasises the teaching of vocational subjects from the lowest possible level. To help meet the national requirements, the whole education system has been remoulded. The scope of the secondary education has been widened, enrolment has been increased and the necessary adjustments in curriculum have been made. In consonance with the objective of the National Education System Plan, the different vocational training institutions are brought under the single umbrella of the Tribhuwan University to co-ordinate the functions of existing vocational institutes. Moreover, as workshop and laboratory facilities are the essential pre-requisits for vocational and science education, schemes are being implemented to make available workshop and laboratory facilities in each of the vocational institutes. Moreover, the National Planning Commission Secretariat also estimates the demand and the supply of manpower requirements by major fields and levels, and make suggestions for necessary adjustments in the enrolment and the outturn of the mid-level and lower-level technical manpower from different vocational institutions. Moreover, it also makes projection of manpower requirements by major fields and indicates the likely shortages and surpluses in different vocational subjects.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status. Are there separate professional bodies for technicians.**

Recognising the important work technicians play in the national development HMG Nepal has given special privileges to the technical personnel in Nepal. The salary scale of the technical staff at different level in the government service is higher as compared with the non-technical staff. Even the vocational teacher at secondary and higher secondary schools receive higher pay as against the non-technical teachers.

The technical personnel in Nepal are also entrusted with the sole responsibilities of execution of different development schemes and additional facilities are given to them wherever they are assigned in some specific development projects. Moreover, the chief of the technical departments are manned by technicians and there are many instances where the technicians have reached the highest ladder in the civil service of His Majesty's Government.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

The present education institutes in Nepal provide study facilities mostly in fields of liberal arts, basic sciences and vocational subjects. Nepal still lacks high level study facilities in fields like medicine, engineering, agriculture and in other related subjects and so depends on training and study scholarships provided by different international institutions, and other foreign countries. As Nepal is one of the major recipient of training facilities among the member countries of the Colombo Plan and also as the pool of technical personnel is still limited in the country, technical personnel in Nepal get adequate opportunities for further study in more developed countries for their professional advancement.

In the field of technical and vocational education, which is still limited to mid-level and basic-level, the National Education System Plan seeks to extend adequate opportunities for the professional advancement. In the previous education system the level of education in the technical field, particularly at mid-level and basic-level completes in itself without any scope for higher study. So the vocational education worked as only a waiting platform for higher education in some other fields, like liberal arts. This has resulted in high degree of attrition among the mid-level and the basic level technicians. In the present National System Plan, adequate provisions are made to extend opportunities for the professional advancement of mid-level and basic-level technicians. Provisions are made for mid-level technicians to attain degree level courses in their field of study once they complete certain years of service in fields where they are trained.

5. **Is any research being undertaken in technician education? If so, name the institutions in which this is being done, and**

6. **What are the important technician education problems in which research could usefully be undertaken in your country.**

The present technician education system in Nepal aims to meet the basic requirements which make a student proficient in some vocations to help him support himself. These facilities are still limited to mid-level and basic-level technical fields and the country has a longway to develop facilities for research and higher study. So the strengthening of existing vocational and technical institutes through the provision of technical support is the basic need to help create a viable base for higher study and research within the country. The creation of institutional base within the country will help ensure the elimination of perpetual dependence on foreign assistance in such technical fields. So Nepal feels that the technical support from the most advanced countries and from the international institutes should be geared towards enhancing research capacities in some of the vocational institutes which are working within the country. At present the technical assistance received is least in the sector which enhances institutional infrastructural facilities and research capabilities within the country.

There are some institutes where the technical assistance has been extended to create institutional base within the country. The Balaju Industrial District, the Technical Training Institute, the Education Material Production Centre, the Patan Industrial District are some of the few technical institutes where external assistance is extended to create institutional infrastructure and research facilities.

7. Does the technical education system provide scope for innovation ?

National Education System Plan has brought about significant changes in the educational structure of the country. The system has given way to the development of new techniques in vocational and technical education. Moreover, the National Education System Plan has also created following institutional frame work to improve and develop educational institutes curriculum and other necessities.

(1) Establishment of curriculum improvement and development centre charged with the responsibilities of framing curriculum according to the changing conditions.

(2) Maintenance of four regional directorates charged with the responsibility of school management as to fulfil the need of the country.

(3) Maintenance of district education offices charged with the responsibility to supervise and execute day to day administration of the schools.

(4) Organization of district education committees are also entrusted with the responsibilities of developing new programmes in their schools.

(5) Organization of district education office charged with the responsibility of appropriating fund required for running the schools.

(6) Construction of vocational workshops in the secondary schools to encourage vocational students carry out new vocational projects.

Moreover, same kind of arrangements have been made in the higher education also to make innovation possible in the field of higher education.

8. Discuss the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education would be utilized to meet your country's requirements over the next five years, in relation within college's three main programme areas: (1) Staff Development and Training, (2) Research and Development, (3) Advisory and Resource Service.

As stated earlier, Nepal still lacks institutional facilities for higher study and training in specialized technical and scientific fields. She will have to rely on international institutions and friendly countries to meet the requirement of professionals and technicians in her development process. So it has been the policy of His Majesty's Government to receive technical and professional fellowship for degree level academic courses. The Colombo Plan Staff College for

Technician Education could help train our staff of the dififferent vocational institutes and other technical personnel who are holding different positions in the country. In Nepal, where institutional infrastructure is still in its infancy, to Colombo Plan Staff College could also extend resources and advisory services in the development of basic facilities required for the promotion of scientific and technical knowledge. The country still needs consultancy services in field which require specialised technical hands and sophisticated technology. Moreover, the National Education System Plan is seeking to standardise text books and maintain uniform standard in terminal assessment and periodic examination. So the Colombo Plan Staff College could also extend its advisory services of and resources in the development of curriculum, workshops and laboratories.

9. **What steps would be taken to promote the expansion of intra-regional training.**

Nepal has been immensely benefited from the present system of technical training. However, it will be more beneficial if the intra-regional institute like Colombo Plan Staff College for Technician Education could also conduct regular short-term country courses to meet needs of the developing countries.

His Majesty's Government also feels that the technical assistance should be widened and include development of basic facilities required for the promotion of scientific and technological knowledge.

PAKISTAN

1. **What are the objectives of the system of technical education in your country?**

Technical education aims to produce middle level manpower for industry in public and private sector. Twentyfour Polytechnics administer post secondary school three year course in 18 technologies. Thus product is called an Associate Engineer who is well-rounded person having gone through a curriculum comprising about 40% theory and 60% practical. He is given a sound education in Mathematics and Science and also in general education subjects. The emphasis at producing a technician who has more competencies in the cognitive domain than in the manipulation side. Recently the emphasis is, however, being shifted to reduce the theoretical component to about 30% and practical to increase to about 70% for producing industrial technicians who have a greater mastery for the practical and industrial skills.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

Our Education Policy 1972-80 provides for intergration of general and technical education at all levels of education to make it more meaningful, purposeful and attuned to the economic and social development of the country. Pre-vocational agro-technical courses have been started from Class VI onwards effective 1974 which would be extended up to Class XII by 1980 and possibly earlier. Under the aegies of National Curriculum Development Wing, national committees have been set up to review the existing Polytechnic curricula and to make them relevant to the industrial context of the country. These committees have already completed their assignment and revised curricula would be operative after final processing, with effect from next academic session. The Government is also planning to provide training places for Polytechnic students in private and public industry through legislation or persuasion or a combination of both. The final strategy for this purpose is being evolved. The Government is also encouraging establishment of institutions and curricula in sectors other than industry.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technicians?**

Recently the Government have increased the salary scales of technician level occupations. B. Tech. Degree (Bachelor of Technology) courses are being provided in some upgraded Polytechnics for ensuring higher educational growth of technicians. At least one body for technicians is functioning under the name of "Diploma Engineers' Association". Up till now their activities were of a Trade Union nature but they are now entering the academic field and are proposing to publish a journal of professional interest. The Institute of Engineers Pakistan also encourages and promotes the Association of Technicians with its work and provides them opportunities for sitting in the Associate Membership Examination. The Institute also fosters student chapters in polytechnic institutes.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

As explained in answer to Question No. 3, technicians can advance professionally through the dual option of going through a B. Tech. Course or appearing in the examinations of the Institute of Engineers. Limited number of seats in Engineering Colleges and Engineering University Lahore are also available for diploma holders. There are no facilities for part-time and correspondence courses for working technicians. However, the newly established "Peoples' Open University Islamabad" is planning to introduce such courses for technicians skilled workers and teachers in collaborations with Polytechnics and other institutions of learning and with public and private enterprise.

5. **Is any research being undertaken in technician education? If so, name the institutions in which this is being done.**

Research as a system has not yet evolved to a great extent in the field of technicians' education in Pakistan. However, Boards of Technical Education in all the provinces with the help of the Federal Ministry of Education have initiated some programmes in this direction. A beginning has been made which, it is hoped, will continue.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

   (i) Curriculum development.

   (ii) Co-operation with industry.

(iii) Students' selection.
(iv) Instructional metnodology.
(v) Teachers' training.
(vi) Evaluation and examination.
(vii) Re-training and up-dating.
(viii) Administration and organisation.
(ix) Placement and follow-up.
(x) Waste prevention.

7. **Does the technical education system provide scope for innovation?**

Technical education does not inhibit innovation. Recent efforts in curriculum regeneration is a case in point. However, we have still a long way to go in developing positive innovative attitudes.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilized to meet your country's requirements over next 5 years, in relation to the Colleges' three main programme areas (i) Staff Development and Training; (ii) Research and Development and (iii) Advisory and Resource Service.**

Role of the Colombo Staff College

(i) As a resource centre for dissemination of information.
(ii) As a catalyzer for senior administrators involved in technician education and planning.
(iii) As a collaborator in country courses.
(iv) As a helper in senior staff development.
(v) As a helper in problem solving through research and development.

9. **What steps could be taken to promote the expansion of intra-regional training?**

Recommended steps

(i) Sub-Regional meeting of technician educators for exploring areas of common interest.
(ii) More international and country courses for involvement of industry in technical education programmes.
(iii) Preparation and distribution of soft ware for educational technology.
(iv) Third country programmes for teachers and students.
(v) Locating institutions and resource persons in regional countries for a two way correspondence to obtain a multiplying effect of Colombo Plan Bureau's activities.
(vi) Wider and persistent circulation and recirculation of Colombo Plan documents on conferences, seminars and colloquia held so far.

PAPUA NEW GUINEA

Objectives

- Preparation of a student to become a useful citizen of the country.
- Impart basic and essential technical skills which he can employ for the betterment of his life and also make him realize his role in the community as well as towards the development of the country.
- Produce skilled tradesmen and technicians to meet the needs and requirements of industry, in the middle sector.

The Five-Year Education Plan

This Plan which is under review at the moment, when approved by the Government will see an almost complete re-organisation of the education system in the country.

Our Technical Colleges which could well be termed as Technical Schools, will no longer offer high school subjects under this Plan and will concentrate on the educating and training of the students in technical disciplines.

In Technician Education, we have to attempt to meet demand certainly while at the same time planning our development on a supply basis because in our emerging economy we may suddenly be faced with chronic shortages of people at the technician level or for that matter at all skilled levels.

Status of Technicians

A question that could be asked here is "How does one obtain status?" A status one enjoys may come as a result of—sense of pride and satisfaction from work.

- qualifications he has attained;
- the position and the job he holds;
- the level of his performance;
- the relative importance and emphasis placed on the type of occupation he has taken up.

There are I am sure other elements which help towards the recognition and achievement of status.

As our technician courses are relatively new, those who have graduated to enjoy status. Commerce Certificate holders in Papua New Guinea have formed their own association and this has paved the way for technicians in other fields to follow.

Professional Advancement

In Papua New Guinea, we aim in producing technicians who are doers. However it is not uncommon to see many of them in administrative and managerial roles. This is due to the rate of localisation the country is under going at the moment.

For the technicians to further their professional advancement, avenues do exist in the country. If they so wish, University of Technology is at their disposal. The Education Department does offer part-time courses.

Research Projects: The Government's Central Planning Office

Research in Technician Education—The C.P.O. has listed a number of research topics that it is interested in pursuing.

These areas include:

- (*a*) Ratio of Professionals (Engineers) to Technicians to artisans (skilled tradesmen/craftsmen) in different occupational levels.
- (*b*) Type of level of skills required in rural development especially in intermediate technology.
- (*c*) Educational Inputs relating to non-formal training, formal education or informal training (on-the-job training)
  - — Examination of educational qualification as conventionally defined in certain occupations so as to determine whether the skills that are conventionally assumed to be regained are those that are effectively required for the successful performance of particular types of jobs.
- (*d*) Causes of "shortages" in artisans/technicians.
  - — Wage/salary structure
  - — Career prospects
  - — Social attitudes
  - — Inadequate training

Innovation

The scope for innovation in the Papua New Guinea education system does exist. This is essential in that any changes in technology does ultimately require changes in skill requirements. This can embrace such areas as suitable facilities for training as well as the type of personnel required to impart such training.

Role of the Colombo Plan Staff College

- — Organise courses/seminars in the areas of technician education management/administration
- — Visiting consultants—this would enable the staff of the college to appreciate the problems in relation to the country's general developmental problems.

Intra-Regional Co-operation

The Colombo Plan Bureau should encourage and foster Intra-Regional Aid in terms of:

- — exchange of expertise
- — scholarships.

PHILIPPINES

1. **What are the objectives of the system of technical education in your country?**

Vocational Education in the Philippines dates back to the Spanish regime when the first vocational school was established in Bacolor, Pampanga.

In 1927, the Philippine Legislature enacted Commonwealth Act 3377 which defined the aims of vocational education and authorized the creation of the Division of Vocational Education.

The objectives of vocational education as embodied in the 1935 Constitution was:

> "All schools shall aim to develop moral character, personal discipline, civic conscience and *vocational efficiency*, and to teach the duties of citizenship".

Basically, the aim of vocational education was to fit pupils(person)for useful employment.

In 1963, Republic Act No. 3742 created the Bureau of Vocational Education as an independent agency under the Department of Education. It was created for the purpose of "strengthening, promoting, co-ordinating and enhancing the socio-economic programme in the Philippines through the development of skilled manpower in agriculture, industrial and trade-technical, fishery and other vocational courses".

In 1969, President Marcos created the Presidential Commission to Survey Philippine Education (PCSPE) and one of the recommendations was the creation of the Department of Education and Culture. In effect, the recommendation was the abolition of the Bureau of Vocational Education and the creation instead of a Bureau of Secondary Education and a Bureau of Higher Education.

September 21, 1972, was a significant date in the history of our country as it was on this date that the entire Philippines was placed under the Martial Law. It is significant in the sense that it was the birth of a New Society.

To effect the desirable changes in the New Society, Presidential Decree No. 1, entitled "Reorganizing the Executive Branch of the National Government;" Presidential Decree No. 2, "Proclaiming the entire country as Land Reform Area"; and Presidential Decree No. 6-A, the "Educational Development Decree of 1972" were issued by President Marcos.

These three Presidential Decrees we believe, are the keystones upon which the future of vocational-technical education in the Philippines will be based on consonance with the New Constitutional Mandate of 1973, which states among others as reflected in Article XV, Section 8 (4):

> "All educational institutions shall aim to inculcate love of country, teach the duties of citizenship, and develop moral character, personal discipline, and scientific, technological and vocational efficiency".

In May 1974, the Bureau of Vocational Education (BVE),, National Manpower and Youth Council (NMYC), the Educational Development Projects Implementing Task Force (EDPITAF), the National Cottage Industry Development Administration (NACIDA), the Department of Social Welfare (DSW), the Development Academy of the Philippines (DAP), and the Fund for Assistance to Private Education (FAPE), and also the private sectors, in a Seminar-Workshop on Vocational Education and Training at the Development Academy of the Philippines took cognizance of the general objectives of Vocational Education and Training, the proper direction in planning and implementation, to effect the proper co-ordination, and maximizing the utilization of the resources in the achievement of the following general goals:

(1) To provide the manpower needs of the developing economy;

(2) To develop the potentials of the human individual to the maximum.

To attain these general objectives, the following specific goals are advocated:

(1) To co-ordinate the various sectors, both public and private for manpower development through vocational-technical education and training (co-ordinate use of men, money and materials).

(2) To create the tools for efficient planning of vocational technical education and training.

(3) To develop a national scheme for vocational and occupational guidance.

(4) To establish a national center for vocational curriculum development.

(5) To promote consciousness of and appreciation for vocational education and training among all sectors of society.

The existing programmes, as a matter of policy at various levels shall be retained and efforts to enrich them are to be initiated and continuing development be carried out.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

The national seminar on "APPROACHES TO CO-OPERATION BETWEEN INDUSTRIES AND INSTITUTIONS IN TECHNICAL TRAINING" held in Manila had brought about excellent results to the country. The seminar as an eye opener led to the creation of a Presidential Commission to Survey Philippine Education (PCSPE) especially on vocational-technical education and training. Specifically, the Presidential Committee recommended policy and recommendation as follows:

(1) That the National Board of Education draw up in consultation with the industry and other government agencies, a detailed plan for development of vocational-technical education;

(2) That high priority be given to the provision of technical education and retraining programmes in order to meet the current and projected needs for trained manpower in a developing industry;

(3) That a National Polytechnic System be established with the Philippine College of Arts and Trades (PCAT) as its nucleus institution in the first instance;

(4) That full-time vocational-technical education at the post-secondary level be provided in comprehensive high schools in which a vocational stream or sets of courses are to be provided in the fourth and fifth years;

(5) That at the post-secondary level, technical education be provided in two types of institutions;

(*a*) institutions offering specialized courses of one, two or three years duration leading to the formation of skilled technicians; and

(*b*) universities and colleges providing regular degree programmes in the various fields of engineering and technology.

These recommendations for technical education are now actually being implemented in vocational-technical schools and state colleges and universities. Some institutions created their advisory committee composed of educators and industry experts who took interest in the welfare of the institution in assisting in the design of technician programmes and its standards. This is done periodically and as the need arises.

3. **Do technicians enjoy a status commensurate with important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technicians?**

Status is the social honour or the social evaluation accorded by others and in this case how industry and society regard the technicians. That, industry values highly technicians is indicated by the high placement of technician graduates in jobs that require technician "know-how" and for which technicians receive rates higher than the government's minimum wage. Technicians are also assured of fixed or permanent tenure and merit based on promotions. All of these are available to those who are adequately trained.

At a State College in Manila and in some other State and private technical schools and universities where a strong technician curriculum is being offered technician graduates are fully trained in work readiness, possessing much leadership potential and adequate working knowledge of industry, creativity in the jobs and willingness to accept responsibilities. Having been properly guided in how to get along well with their superiors, trained technicians are imbued with positive attitudes and adequate abilities to grow with industry, habits of promptness, thoroughness in the job, and in spirited enthusiasm in the performance of job assignments.

The preparation of technician also includes a proper orientation to company rules and regulations as well as training for thoroughness in the job which includes an eager search for related information about his job. The technician is likewise prepared to assume future responsibilities for the performance of other jobs and a willingness to share in the accountability for the future of the company.

However, the technicians despite his preparation would suffer from certain limitations as follows:

(1) Strong leadership potentials as expected by industry have not as yet been put across by the technicians due to the situational difference and their inability to adjust to another environment caused by abrupt changes in social environment found among industries.

(2) Work climate, tools, machineries, materials and peers in college differ much from those found in industry. It takes so much of social adjustment in the technicians to be able to shun characteristics of self-assurance, of self-confidence resulting in leadership.

(3) It is a common knowledge that students coming from technical schools possess inferiority complex due to the prevailing public stigma of low regard for manual labour and poverty. In due time as they climb into technical excellence and social acceptance, leadership potentials in industry are most probable to develop in them, hence their technical as well as social status will be enhanced.

As of now, there are no definite professional bodies or organizations helping improve technician status except for the Philippine College of Arts and Trades being proposed the nucleus in the Philippines in the education and training of technicians for industry. The PCAT is therefore committed to prepare and produce not only job oriented but also socially oriented technicians.

In order to improve further the education and training of future technician level of industrial workers for the better and which will elevate economic as well as the social status and acceptance of the technician, the following are recommended:

(1) Strengthen and expand the technician curriculum along knowledges and skills in the development of a course in Industrial Technology for professionalization of technicians.

(2) Provide as often as the need arises work situations other than those obtained in schools. Bring students to actual industrial situations to facilitate easy adjustment, (on-the-job-training).

(3) Motivate students to adopt necessary and desirable attitudes towards work that they want.

(4) Provide enough suitable teachers, well-trained, educationally qualified, and concerned in uplifting students from the level of "ignorance to the level of enlightenment".

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians ?**

The Philippines have been known to be second to the United States in the number of learning institutions throughout the world. It is also a fact that many foreign students come to the Philippines to study and finish their engineering, masteral doctoral and other degree courses.

Although these are scattered through the islands, most of them are found in the Greater Manila Area which are accessible to land, water and air transportation, to factories and big industries and to living and boarding facilities. Hence, opportunities for the advancement and professional growth is very conducive.

Industries in these areas are normally run into two shifts, these are the day and evening shifts. Those working in the day shift have every opportunity to go to the evening programme offered by government and private colleges and universities. These working in the evening likewise have all the opportunity to study in the day programme.

Some technicians although limited in number do take up correspondence courses however, attendance to it is not being acknowledged and credited by school authorities concerned.

There is in existence of Regional Training Centres like the Philippine-France Pilot Training Center for electrical trades, and the SEATO Technical Training Center which trains technician for textile mill maintenance, machine-shop practice, and allied mechanical trades. Those centers are located at Marikina School of Arts and Trades, Marikina, Rizal.

5. **Is any research being undertaken in technician education? If so, name the institution in which this is being done?**

As of this date, no formal and exhaustive research on technician education in the Philippines has been initiated yet/or conducted, except in piece-meal form such as the conference on technician education directed to identify the profile of a technician within the purview of Philippine needs and definition as sponsored by the Educational Development Projects Implementing Task Force (EDPITAF); a survey of the *prima facie* existence and need for technician in the Philippines as part of the Presidential Commission to Survey Philippine Education (PCSPE) Report in 1970 which serve as a basis in establishing three (3) Technical Institutes, and the De La Salle Seminar-Workshop on Technical Education held in 1972 that resulted in the subsequent opening of the Industrial Technical Programme in the same school.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

Among the suggested researches and/or focus of investigation in technician education are:

(1) Study of the real needs for Technician Manpower in the Philippines and/or in the Third World in the light of the Technological Advancement and Requirements.

(2) Classification and Description of the Technician's Job in the Philippines and/or in developing countries.

(3) Selection and Development of Technician Trainers: Criteria and Procedures.

(4) The Technician Institutes in Developing Countries: Their Facilities. Organization and Management.

(5) Methods and Venues of Training Technicians.

(6) Curriculum Designs and Strategies in Technician Education.

(7) The Role of Industry in Technician Education.

7. **Does the technical education system provide scope for innovations?**

Innovations are welcomed.

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8. **Describe the ways in which the resources and Facilities of the Colombo Plan Staff College for technician education could be utilized to meet your country's requirements over the next five years; in relation to the colleges three main programme areas: (i) Staff Development and Training: (ii) Research and Development and (iii) Advisory and Resource Service.**

   (1) Plan and implement a teacher-technician curriculum where selected scholars from Colombo Plan countries can enrol.

   (2) Extend the resources and facilities of the Colombo Plan Staff College for Technician Education to other member countries which are in a position to offer the same in their region like the Philippines.

   (3) Authorize Colombo Plan countries to offer Staff Development and Training Programme, if its resources and facilities warrant.

9. **What steps could be taken to promote the expansion of intra-regional training?**

   (1) Know the problems confronting a region through an exhaustive survey.

   (2) Intra-regional training to be based upon the need of the respective region.

   (3) Promote a continuing dialogue among Colombo Plan countries aimed at improving the technician training programme. A colloquium scheme could be adopted in this regard.

SINGAPORE

1. Objectives of the system of technical education in Singapore

1.1 General:

(*a*) To ensure that the industrialisation programme of Singapore will not be hampered by lack of skilled manpower;

(*b*) To reduce on the previously prevailing preponderance of school leavers with a purely academic education;

(*c*) To bring about a change in the prior prevailing preference for white collar occupations among school leavers;

(*d*) To develop manual dexterity and technical knowledge as a national characteristic.

1.2 At Lower Secondary (1st and 2nd Years) Level:

(*a*) To introduce students to manual skills through basic workshop subjects and technical drawing;

(*b*) To help students see the possibilities of successful careers in jobs requiring skills.

1.3 At Upper Secondary (3rd and 4th Years) Level:

(*a*) To increase on the proportion of students in the Technical Stream and distinct from those in the Academic Stream;

(*b*) To provide more advanced basic training to prepare students for admission to skill training courses in vocational institutes or for admission to technician training courses in technical colleges;

(*c*) To prepare students for Pre-University and University education in Science and Engineering;

(*d*) To prepare students for employment on leaving school in jobs requiring some basic technical knowledge and skills.

1.4 At Post Secondary (Pre University) Level:

(*a*) To prepare students for science, engineering and technological courses in universities;

(*b*) To prepare students for employment on leaving school in jobs at technician level.

1.5 In Vocational Institutes:

(*a*) To provide training courses which meet the specific needs of particular industries or firms;

(*b*) To provide basic training up to semi-skilled worker level enabling those completing such courses to take up employment requiring basic industrial skills which can be developed to higher levels through apprenticeship and on-the-job training.

1.6 At Technical College Level:

(*a*) To train different categories of Technicians (Craft/Industrial, Engineering, Design, etc.);

(*b*) To prepare students for employment as design, maintenance, supervisory and control technicians, training officers and technical school teachers.

1.7 At University Level:

(*a*) To provide training to future technologists in the various engineering disciplines;

(*b*) To conduct research in response to problems posed by industries.

2. Measures adopted in recent years to make a technical education responsive to needs of Singapore

2.1 Expansion in technical education and training facilities:

	Type of establishment	*Nos. in* 1968	*Nos. in* 1975
1.	Centralised Workshop	0	15
2.	Secondary School Workshops	9	19
3.	Vocational Institutes	1	11
4.	Technical Colleges	2	3
5.	University Engineering Departments	2	4

2.2 Expansion in technical education enrolment:

Type of establishment	*Enrol. in* 1968	*Enrol. in* 1975
1. **Secondary Schools**		
(*a*) Lower Secondary (Yr. 1 & 2)	7504	43717*
(*b*) Upper Secondary (Yr. 3 & 4)	3770	15827*
(*c*) Post Secondary (Yr 5 & 6)	0	1131
2. **Vocational Institutes**		
(*a*) Full-time classes	1038	8600†
(*b*) Part-time classes	1019	4000
3. **Technical Colleges**		
(*a*) Full-time classes	1044	6068‡
(*b*) Part-time classes	1462	3763‡
4. **University Engineering Faculty**	314	1004‡

Note: *Enrolment as at June 1974;
†Includes projected mid-1975 intake;
‡Does not include projected 1975 intake.

2.3 Establishment of the Industrial Training Board:

The Industrial Training Board was created in April 1973 to centralise co-ordinate and promote the widening scope of industrial training.

2.4 Exposure of Students to Technical Education:

All boys and fifty percent of the girls in the initial two years of Secondary Education are given exposure to basic workshop skills through activities involving the use of hand tools.

2.5 Development of Centralised Workshops:

Centralised Workshops are developed to serve the technical training needs of students in secondary schools which did not have such training facilities.

2.6 Equal Opportunity for Females:

In selection for admission to technical education or training programmes female candidates are given equal opportunity;

2.7 Development of Technician Courses:

Two types of courses were developed, the first leading to the award of a Diploma takes three years full-time or five years part-time, while the second leading to the award of a Certificate takes two years full-time or four years part-time. The range of disciplines covered in technician courses is also being rapidly expanded.

2.8 Career Guidance:

An Orientation Programme to familiarise primary school leavers with programme of the centralised workshops has been held regularly since

1971. Vocational and other relevant information on employment continue to be disseminated in forms other than the written word through Career Masters. Seminars, talks, film shows are other means employed to inform school children about the World of Work. Visits are also organised to vocational training institutes, factories and other work sites.

2.9 Aptitude Testing:

During their initial two-year period of secondary education, pupils are assessed and tested to evaluate their aptitude for technical studies. These tests include mechanical, co-ordination and spatial correlations tests. Only those who are found to be suitable are permitted to proceed to training in technical fields, either in upper secondary classes or vocational institutes.

2.10 Retraining, Upgrading and Recruitment of Teaching Staff:

To cater to the large expansion in enrolment of technical education and training establishments the following measures were adopted:

(*a*) Retraining of teachers for technical trades;

(*b*) Upgrading of skills and knowledge of existing teachers through local or overseas training courses;

(*c*) Recruitment of additional staff from local as well as overseas sources.

2.11 Apprenticeship Training:

Emphasis is being given to the development and expansion of apprenticeship training programmes.

2.12 Industry/Government Joint Training Schools:

To increase on training facilities and places available and also to take advantage of overseas industrial training experiences, the Government has collaborated with some multi-national companies to operate Joint Training Schools. Three of these have already been established.

2.13 Overseas Industrial Training Schemes:

The Economic Development Board operates a scheme through which it finance selected local craftsmen for overseas industrial training to more advanced levels.

2.14 Trade Advisory Committees:

The Industrial Training Board and the technical colleges have Trade Advisory Committees to advise them on the nature and content of trade and technician training. The Advisory Committees comprise members drawn from people of wide industrial experience. Their service have been most useful in the development of training curriculum and syllabuses to produce craftsmen and technicians of relevance to industrial requirements.

2.15 National Trade Testing:

A system of National Trade Testing has been established with the following objectives:

(*a*) to certify to levels of competence in designated trades;

(*b*) to ascertain the level of technical competence within the country;

(*c*) to provide incentives for workers to improve their technical skills and knowledge;

(*d*) to provide the basis for equitable reward for work based on ability.

3. The Status of Technicians in Singapore

3.1 In the private sector technicians have always enjoyed a status commensurate with the work they do. In the current period of shortage of skilled technical manpower, technicians tend to command more than average salaries.

3.2 In the Government sector, technicians are paid on salary scales depending on their technician qualifications. There is opportunity for rapid advancement through proven ability. The salary scales for different categories of technicians have been revised and upgraded within the past few years.

3.3 There is no specific professional body for technicians in Singapore. However, many of the technicians are registered with professional bodies overseas.

4. Opportunities for professional advancement of technicians

4.1 Technicians enjoy good opportunities for career advancement through competency and productivity.

4.2 Part-time courses are provided by vocational institutes and technical colleges. As can be seen from the table in para 2.2 part-time students form about one-third of the enrolment of such training establishments.

4.3 Aside from opportunities to qualify for certificates of local technical colleges, technicians can take external examinations like those offered by the City and Guilds of London Institute.

5. Research in Technician Education

5.1 Very little has been done on this. The pre-occupation until now has been on expansion of training facilities and places. The Industrial Training Board in collaboration with the Ministry of Labour and the Economic Research Centre of the University of Singapore has conducted some surveys on the employment of technicians and skilled manpower.

5.2 It is expected that such research will soon be undertaken.

6. Important Technician Education Problems for Research

Suggested areas are:

(*a*) Reliable selection process—to predict with an acceptable degree of accuracy the potential of an individual for the course he wishes to pursue. This will cut down on training wastage and personal frustration;

(*b*) Identification of skills and attitude required for a job to enable training to be more meaningful and directed to the job for which a person is being trained;

(*c*) Reliable testing procedures to evaluate a person's real attainment in the course followed. Most current testing procedures test memory ability (knowledge of theory) but fail to reflect perception and behavioural attributes desirable for successful and satisfying work execution;

(*d*) Manpower Studies to determine the nature and the quantity of technicians and skilled manpower required.

7. Opportunity for Innovation in the Technical Education System

7.1 Opportunities are extremely limited. Firstly, the society is not yet 'technical-minded'. Singapore has had a history of commerce. Until recently emphasis has been on academic excellence rather than technical competence. Secondly, teaching so far has aimed at transfer of knowledge skills rather than of development ideas and concepts.

7.2 Technical schools, vocational institutes and technical colleges are beginning to switch 'project-orientated' training rather than remain 'syllabus orientated'. Under such conditions the opportunity for innovation will gradually become more.

8. Role of the Colombo Plan Staff College in meeting Singapore's requirements

As per the six functions listed in the Memorandum of Understanding which led to the establishment of the Staff College.

9. Measures to promote the expansion of intra-regional training

9.1 Provision of fellowships for short attachments and exchange visits to study at first hand the technical education systems of other countries. Such attachments should be of 3 to 4 months' duration to be meaningful.

9.2 Development of country specialisation in training areas of significant importance to the country, in which there is the advantage of relevant practical training, e.g. TELECENTRE in Singapore, BIOTROP in Bogor and TROPMED Centres in SEAMEO countries. Trainees from participating countries can come to the Specialist Centres for training. Duplication of similar specialist facilities in several countries would amount to waste of scarce resources.

9.3 Organisation of Country Workshops and Seminars which are orientated to problem-solving rather than policy or philosophy expounding sessions

The problem may be country-specific, but the participants from different countries can contribute suggested solutions.

9.4 Interchange of ideas on training, innovation, techniques, programmes through a clearing house—one of the roles of the Colombo Plan Staff College.

SRI LANKA

1. Technician Education System Structure in Sri Lanka

Engineering courses at technician level in Sri Lanka are structured to train manpower for middle grades of engineering and industrial employment. There are two categories of courses presently available for Technician Education. The first type provides a full-time institutionalised programme complete with adequate workshop experience to complement the related theoretical studies including technical drawing. Institutionalised training is followed by a one year full-time programme of practical "on-the-job" training in the relevant industry. This experience provides the trainee an opportunity of working with the men and machines in his field of engineering and to see for himself the practical problems to be faced on the shop-floor.

The second category of technician course is conducted part-time and is meant for those employed during the day in the relevant fields of engineering. The main objective of this course is to provide institutionalised instruction to technicians in the field so that they would be able to obtain paper qualifications to support their shop-floor experience. This programme of training will enable the technician to understand the theory behind and the purposes of the operations for which he has supervisory control.

2. Types and Duration of Courses Relating to Technician Education Prior to 1969

(a)	Junior Technical Officers Certificate—in Civil, Electrical, Mechanical and Chemical	2 years, full-time day
(b)	Draughtsman Apprentices	1 year, full-time
(c)	Surveyors & Levellers	1 year full-time and 3 years part-time
(d)	Building Construction	3 years, part-time
(e)	Builders Quantities	2 years, part-time
(f)	Mechanical Engineering	3 years, part-time
(g)	Electrical Engineering	3 years, part-time
(h)	Structural Engineering	3 years, part-time
(i)	Municipal Engineering	3 years, part-time
(j)	Architectural Engineering	3 years, part-time

After 1969

(*a*)	National Diploma in Technology—in Civil Mechanical (Production), Mechanical (Automotive), Electrical Power, Electronics & Telecommunications and Chemical	3 years, full-time day (2 years institutional training and 1 year in Plant training in industry)
(*b*)	Draughtsman Apprentices	1 year, full-time
(*c*)	Surveyors & Levellers	1 year, full-time and 3 years part-time
(*d*)	Building Construction	3 years, part-time
(*e*)	Builders Quantities	2 years, part-time
(*f*)	Mechanical Engineering	3 years, part-time
(*g*)	Electrical Engineering	3 years, part-time
(*h*)	Structural Engineering	3 years, part-time
(*i*)	Municipal Engineering	3 years, part-time

3. **Types of Graduates (Certificate, Diploma, Degree)**

Prior to 1969

(*a*) Those following the full-time courses obtained a Junior Technical Officers *Certificate* for the relevant field.

(*b*) Those following the part-time courses obtained a *Certificate* for the relevant field.

After 1969

(*a*) Those following the full-time courses obtained a National *Diploma* in Technology for relevant field.

(*b*) Those following the part-time courses obtained a *Certificate* for the relevant field.

4. **Courses of Training for Technicians, Indicating Whether Fully or Partly Subsidised**

Please see details, including entrance requirements, subjects for the separate years of study in the 'Directory of Technical Education' which is attached.

All courses full-time or part-time are fully subsidised by Government. Those following the part-time (evening) Technician courses have to pay Rs. 10/- per month of study.

5. **Working relationship between the Ministry and Institutions, the Ministry and the Community, the Institutions and the Community particularly in regard to:**

(*a*) Ratios in various training categories between the manpower needs of industry and graduates produced;

(*b*) The role played by industry in designing and updating courses.

The Technical Education Commission which published its report in 1963 mentioned that the expansion of technical training facilities could be pursued vigorously without fear of saturating the employment market! However. 12 years later, we see that employment for those at technician level is not easy to find and there are many who are either unemployed or under-employed. According to the estimates of additional annual requirements of technically trained personnel the requirement for technicians of all types is in the region of 1000. This figure covers not only new needs, but replacements as well. The present turnover of technicians per year is estimated to be in the region of 500 of which 300 are those who have completed the formalised N.D.T. courses. The others are those who have other technician training programmes in the government departments/corporations and the private sector. Considering the present growth of Engineering Industry in Sri Lanka a turnover of 500 technicians per year is adequate on the normal staffing ratio of 1 engineer: 5 technicians: 25 craftsmen.

As compared to an annual additional requirement of 1,000 technicians, the corresponding requirement of engineering craftsmen of all types is 5,000. However, a manpower survey regarding the supply and demand of skilled level manpower, 1969-78, done by the Employment Division of the Ministry of Planning indicates a demand of only 2,000 additional craftsmen per year. The supply position is also about 2,000 craftsmen per year.

THAILAND

1. **What are the objectives of the system of technical education in your country?**

Since the development programme of Thailand has involved to industry, the programme for vocational education has been emphasised more and more to meet the needed manpower in various professions for the country. So the system of technical education was extended to broaden the programme of vocational education in the higher level. The main objectives are expected for the further skilltraining and actual practical experience in industry, and by the same time various terminated technical training programme are geared to specific professions with more working capabilities intended to meet the demand of the industries.

2. **What measures have been taken in recent years to make technical education responsive to the needs of the country?**

In recent years the Department of Labour has surveyed the demand of the manpower for industries. It showed that the demands in some technical profession are lacked behind the needs of the industries especially where higher technique and skill are required while other technical practices are surplus such as in the area of building construction. The surveying is a good measurement for the direction of technicaleducation to meet the needs of different parts of the country. The present practice of technical education for the country as a whole seems to be directed to the same channel. This is a costly investment that becomes a waste as far as the different needs of skilled manpower in different parts of the country are concerned. As a matter of fact to overcome this problem, an intensive survey for the needs of profession is being considered by planning functions of the government to make technical education responsive to the needs of the country.

3. **Do technicians enjoy a status commensurate with the important work they do? If not, what measures are planned to improve their status? Are there separate professional bodies for technicians?**

There are many problems involved in technical training and technicians itself such as misleading manpower projection, overcrowding of schools, social pressure and lack of job in certain areas. Among those the social pressure is playing an important role for the technicians since they aim to continue at Bacholar level. This seems to be the result of social requirements for a higher prestige and a better status. Since the professional bodies for technicians are separated in small groups, so the image of the bodies are not strong and uncomparable to the engineers. This creates a problem to the profession because the country needs more technical skill while the technicians are running for the degrees. This is a big gap in technical education and the technicians, and a strong measurement is needed for an improvement of the atmosphere. So this brings an innovation to technical education and the degree programmes are set up in the form of production engineer or technologist. At the moment three institutes of technology are established in Bangkok area and a new one is being considered. These aim to improve both technical education and also technician status.

4. **What opportunities exist for the professional advancement of technicians? Are there facilities for part-time and correspondence courses for working technicians?**

Since Thailand is a developing country, it is assured that there is a big demand of technicians for the country. The advancement in higher technique and technology must be standardized, and the technicians need to be more specialized in various fields. The technicians have more chance to work for their full abilities and by the same time they can spend part-time for further study in special programme in school or extension programme of study to the degree level. At the moment the part-time programmes are limited within a number of courses and in the evening sessions. It is expected to provide the technicians for more opportunity in professional advancement programme in the near future.

5. **Is any research being undertaken in technician education? If so, name the institutes in which this is being done?**

Surveying of needs and enrolment in technician education are being conducted by the Vocational Planning Section of the Department of Vocational Education. But those surveying do not measure deep into problem solving. So the end result of the research is still vague, because lack of staff and budget to direct the research as a whole. This should be brought to an urgent consideration for the improvement of technician education.

6. **What are the important technician education problems in which research could usefully be undertaken in your country?**

There are many problems determining technician education in Thailand. The most serious problem to the least one is presented as follows:

(1) Lack of competent and well-qualified teachers;

(2) Insufficient budget, and short of materials, equipment and buildings;

(3) Lack of good text-books, manuals, workbooks, A-V materials and library facilities;

(4) Lack of skill training, practices, on-the-job or factory training, industrial skills, farm practices and business experiences;

(5) Misleading manpower projection; lack of job opportunity in government and private sectors.

(6) Lack of vocational guidance and placement services;

(7) Lack of graduate follow-up study;

(8) Drug abuse and alcoholism among the students.

7. **Does the technical education system provide scope for innovation ?**

The present system of formal technical education provides a wide scope for innovation in various ways. Firstly, the concept of education in technician level must be made clear whether it intends to produce industrial or engineering technician. The technician programme should emphasize practical industrial know-how and added skills is required in foremen and supervisors. Secondly a wide research in production of manpower in both technician and professional level to meet the needs of the industries. Thirdly, the innovation of education should be emphasized in uniform curriculum throughout the country to suit the socio-economic need in each locality differs, and serve for more employment. Besides these the improvement for technical teachers training should be carefully planned along with the improvement of technology and practical works.

8. **Describe the ways in which the resources and facilities of the Colombo Plan Staff College for Technician Education could be utilised to meet your country's requirements over the next five years, in relation to the College's three main programme areas:**

(1) **Staff Development and Training:**

Staff Development and Training programme should be worked out through the Colombo Plan Division of the Department of Technical and Economic Co-operation (D.T.E.C.). The training programmes could be included in seminars; workshops, and institutes, etc.

(2) **Research and Development:**

A normative survey on systems of technician education in the region should be conducted and published and a manual for technician education administration should be developed to assist the developing countries in improving their programme.

(3) **Advisory and Resource Service:**

Advisory and Resource Service would be conducted through co-operative programme between Colombo Plan Division of D.T.E.C., Department of Labour, Department of Vocational Education, Department of Industry and other government organizations and private sectors concerned.

9. What steps could be taken to promote the expansion of intra-regional training ?

The intra regional training should be emphasized more on development projects such as exchange of technicians, promote a regional technical skill contests and exchange of technical training programme and curriculum materials.

On the research projects should develop a comparative study in the roles of technicians and engineers and establish qualifications and status of technicians.

Outlines given by the Representatives of International Organisations' current programmes in the field of Technician Education

STATEMENT BY COLOMBO PLAN STAFF COLLEGE FOR TECHNICIAN EDUCATION REPRESENTATIVE

by

DR. L. S. CHANDRAKANT

Mr. Chairman, coming as I do at the tail end of a long session I must be very brief. At the outset I should like to assure my distinguished friend from Singapore that I am not going to sell the Staff College under any brand name, imperial or otherwise. The only predetermined role of the Staff College is that it should be responsive to the needs of the countries in the region and reach out to fulfil those needs. That is the only charter. From the presentation of the Country Reports this morning it is evident that all countries in this region are making efforts to develop systems of technician education and training in relation to the socio-economic needs. It is also evident that the planning for systems of education, the development, the implementation of the systems have to take place at different levels and also they have different dimensions. In all these efforts the human factor is the most important. You will agree that no system of education is better than the people who manage it. Therefore there are certain broad areas of concern to all the countries in which the resources of the countries in terms of manpower need to be developed on a continuing basis. From the presentation of the reports again some of these areas have been very clearly defined. The senior administrators, the planners, the decision-makers, they all need to be trained in the planning processes. At another level there are the heads of technician institutions who are responsible for putting through a curriculum, developing the curriculum, bringing in innovations to make the entire system respond on a continuing basis to the needs of the industry, they need to be trained and they need to be developed. At another level there are those who are concerned with training the teachers, you may call them the teacher educators on whom depends the quality and standard of the technician education programmes. Now these are primarily the areas with which the Staff College will be concerned and it is in these areas that the Staff College proposes to extend its expertise its programmes to the countries in this region. If I take one particular programme, that is the first programme that was conducted, I am very happy to see at least four of the participants here. It was addressed to the senior administrators or directors of technician education who are concerned with the planning processes. We did not teach them in the conventional sense, we brought them together to discuss these problems, in fact to identify the problems more precisely and look at these problems in their national context and find their own solutions. We were only provoking them to do so through syndicates, through plenary sessions, through other forums of interactions we promoted the idea of a co-operative effort in solving the problems of technician education. It is exactly on these lines that we propose to conduct the rest of the programmes in the college. We identify on a continuing basis again those needs of the member countries in the region that need to be fulfilled by us, at least we will not invent to the needs. The needs have to come from the countries concerned. Therefore, some of the areas like curriculum development, innovations, teacher training, the methodological approaches to testing and evaluation, all these become the central themes of our programmes. So the Staff College programmes, the so-called College based programmes will be especially addressed to these problems which are common or at least largely common to most of the countries in the region. As a complementary effort there are the country programmes that the College proposes to conduct. Each country has its own special problems, problems characteristic of the situation in which the country is trying to develop its technician education. It is for the countries concerned to tell us what those problems are, how they have arisen, what can be done by the Staff College in order to help the countries concerned in confronting those problems and dealing with them. We cannot solve the problems, we can only work with you and help you to solve them. So the country programmes are specially addressed to specific problems identified by each country and in co-operation with and with the assistance of the countries concerned we propose to conduct the country programmes. Now no programme or no course of the Staff College will have the vitality, will have the integrity, unless it is supported by adequate research and project development work by the Staff College. This again will be one of the main areas in which the Staff College proposes to operate. Again, good practices are there, extraordinarily good developments are taking place in different countries, again problems crop up as each country progresses. There should be an adequate system of communication for the exchange of ideas, for the exchange of experiences and a host of other things. So far in the field of technician education there is no such clearing house agency or organisation serving this purpose, helping the countries to know more of each others problems, experiences and so on. So the Staff College has identified itself in this particular role as well to be a clearing house for the collection and dissemination of information on all aspects of technician education and training. The last word that I wish to add is that nothing survives which is not living and dynamic and our own survival depends upon how we build up our own faculty. It is here that we look to expertise, the experiences and so on of the member countries. This is a collective enterprise and it is a collective quest that we find our own opportunities and our rewards.

STATEMENT BY COMMONWEALTH SECRETARIAT REPRESENTATIVE

by

MR. P. D. SNELSON

The Commonwealth Secretariat welcomes the opportunity to attend meeting of Colombo Plan countries. It is by participation in meetings such as this that my colleagues and I are able to become better informed of the problems of countries in the Colombo Plan region, to familiarise ourselves with the various programmes that are conducted under the Colombo Plan umbrella, and to identify areas where the Commonwealth Secretariat may be able to assist with the implementation of these programmes.

The Commonwealth Secretariat's involvement in the education and training of technicians dates from 1966 when a successful conference on this subject was held in Huddersfield, England, attended by specialists from nearly all Commonwealth countries. Delegates will be interested to learn that up-dated version of the report of the Huddersfield Conference will be published shortly by the Secretariat. The publication will contain a good deal of material that is of direct relevance to the issues with which we are now dealing here in Kuala Lumpur.

Another example of the Commonwealth Secretariat's interest in technician training is a survey that has just been completed by an expert from India, (commissioned by the Secretariat) of the opportunities for practical training in industry, that are available for trainee technicians in Commonwealth countries in the sub-continent and South East Asia. The findings of the survey, and of similar surveys in other parts of the Commonwealth, will be published later this year.

The Secretariat's main instrument for the provision of technical assistance is the Commonwealth Fund for Technical Co-operation, which was established in 1971, and is supported by all Commonwealth governments on a voluntary basis. Through the CFTC, the Secretariat makes available technical assistance to Commonwealth developing countries to assist them in meeting their national development priorities.

The Fund's operations are conducted through three programmes:

(*a*) *The General Technical Assistance Programme*, under which experts, whether advisory or operational, drawn from all parts of the Commonwealth, are made available in a wide range of inter-related fields of economic and social development, including, of course, educational development.

(*b*) *The Export Market Development Programme*, which provides technical assistance geared to the expansion of exports, and undertakes market research and trade promotion studies.

(*c*) *The Education and Training Programme*, which provides awards to enable students from Commonwealth developing countries to undertake study or training programmes in other Commonwealth developing countries.

The aims and priorities of the Education and Training Programme are very much in line with those of the Colombo Plan intra-regional training scheme, in that the main thrust of the Programme is directed at the training of middle level personnel in technical and allied subject areas.

The types of training that are supported by the Education and Training Programme are very varied and cover formal as well as informal training. Let me give one of two examples. A small group of technicians from the Posts and Telegraphs Department of Malawi recently completed a year's course at the Telecommunications Training Centre here in Kuala Lumpur. Twenty-five technicians from Tanzania are currently undertaking a course arranged by the National Small Industries Corporation in New Delhi with the aim that, on completion of their training, they will assist in the development of small industries in the Ujaama villages of Tanzania.

Informal training includes study visits and training attachments. At present, we are arranging for two officials from the Sugar Corporation of Sri Lanka to be attached for one year to the comparable organisations in Mauritius where they will study the sugar-cane economy. A third person from Sri Lanka will shortly be going under CFTC auspices, to Jamaica for a training attachment in distillation and the preparation of rum and other liquors.

The CFTC is sometimes able to support *ad hoc* regional training courses. For instance, we are funding a course for instrument technicians that is shortly to be held at the Carribean Meteorological Institute in Barbados. In Nairobi, a course for transmitter technicians and engineers from broadcasting organisations in 12 African countries, arranged by the Commonwealth Broadcasting Associations, is currently taking place with CFTC funding.

Seminars and workshops may also qualify for CFTC support, provided the programme is designed to provide a training experience for the participants.

These few remarks will suffice to indicate the scope of the assistance that can be provided to Commonwealth developing countries in fields that contribute to social and economic development. During the course of the Colloquium, and in discussion with the Director of Colombo Plan Bureau, it has become clear that CFTC can perhaps usefully contribute to the further development of the intra-regional training programme for technicians in two ways. First, it can provide third party funds for awards for intra-regional training where Commonwealth bilateral resources are not adequate. Secondly, the CFTC may be able to assist with the funding of some activities of the Staff College. I am glad it will be possible to explore this possibility further with the Director of the College in Singapore next week.

CFTC assistance can, of course, be offered only to those countries that are members of the Commonwealth family. Following discussion with the Director of the Bureau, however, I am optimistic that the two types of possible support that I have mentioned would be of some value and could have a spin-off effect that would benefit non-Commonwealth Colombo Plan members, as well as Commonwealth countries. Within the terms of reference of the CFTC, and our financial limitations, we in the Commonwealth Secretariat will certainly do what we can to support the intra-regional training programme, the importance and value of which has been amply demonstrated during our discussions this week.

STATEMENT BY ILO OBSERVER

by

MR. R. LA SERRA

On behalf of ILO I must not make a statement but first of all say that as usual for the so-called experts who are working technical co-operation programmes what they learn is much more than that they can give and because the aim is always to spread whatever information or knowledge we have I will try to just place some information here that may be of interest to the delegates in this Colloquium. The papers presented by Mr. Ainuddin, Mr. Parvez, Brigadier Connelly and Dr. Chandrakant; the comments provided by the authors and by Mr. McGregor and by the delegates must be considered as a basis, a very important basis for the main area of development of the activities of the Colombo Plan region. In particular I must refer to the points so clearly indicated by Mr. Ainuddin and Dr. Chandrakant, because of their complete harmony with the concept, principle and line of action of ILO directed towards the application of modern technology to vocational training in Asia. In order to give to the Asian countries the opportunities of establishing regional or sub-regional programmes for technical skill promotion and vocational training, materials, techniques, development, the ILO, under request of the Asian Ministers of Labour, have proposed the creation of the Asian Manpower Skill Development Programme which will be responsible for research and recommendation in the development of training material, the organisation of seminars and workshops for the dissemination of information training and the training of counterpart staff, etc., and will generally promote and co-ordinate regional activities through national focal points and the network of selected national training institutions. The proposal has been approved by the UNDP development programme and the programme will start any time from now. The Asian Manpower Skill Development Programme, is just one of the practical applications of the recommendations that will be discussed for approval next June by the 127 countries participating in the 60th General Conference of the ILO. It has been prepared after a close collaboration with Unesco and wide consultation and participation of all countries and its approval means that many of the initiatives discussed here have the official approval of the governments, employers and the unions in all the States that will approve it. I will just read four titles of the articles included in this Convention and Recommendations that the States will sign in....

"The General Conference of the International Labour Organisation adopts this convention and recommendations. Member States shall adopt and develop comprehensive and co-ordinated policies and programmes of vocational guidance and vocational training closely linked with employment in particular through public employment services. These policies and programmes should take due account of the stage and level of economic and social development and the mutual relationship between human resources development and other economic and social objectives and should be pursued by methods that are appropriate to national conditions at present. Members should ensure that such programmes are compatible with the right to freedom of choice in selecting an occupation and to fair promotion opportunities as well as the right to education. Members should gradually extend or adapt their vocational training systems to meet the needs for vocational training throughout life of both young persons and others in all sectors of the economy and branches of economic activity at all levels of skill and responsibility. Persons in charge of the work of others should have an obligation to make an effective contribution in order to stress further training plans."

The whole book contains these things and I have just read five titles of articles. The last title I have read just refers to the duty for everybody to participate personally in the process of development of human resources. This is the reason why I told that technicians must be considered also as teachers transmitting their knowledge to others. As commented before, ILO considers of primary importance the strictest co-operation between the Colombo Plan Staff College and the Asian Manpower Skill Development Programme and I can confirm here to Dr. Chandrakant the best intentions of the Director of the ILO Regional Office for Asia, Mr. Jain for this co-operation. The programmes of the Colombo Plan and the ILO can be complementary in more than one area of common interest for the countries of the Colombo Plan region and the 25 years of experience of ILO in the different fields related to training may result in being very useful for everybody who is concerned with this very basic field of human resources development. At present ILO is engaged in South-East Asia in 58 projects of technical co-operation in the area of training which includes assessment of training needs, systems of guidance and selection, trade skill testing and certification and a lot of areas that normally in the traditional way are not included in training but are an essential part of training. All these projects are worth more than 30 million U.S. dollars, transferring knowledge and information and providing easy access to them, to the countries participating in this programme help to avoid the mistakes that have been done elsewhere. This is a very important side of the transferring of information. One of the intra-regional approaches started this year with the purpose of designing a vocational training system using models of employable skill, is financed by the Swedish Institute for Technical Co-operation for an amount of over one million U.S. dollars and ILO will be glad to compare with the Colombo Plan Staff College all the results of these projects, not new, but now frame system of training that can be very usefully used both from the technical and the methodological point of view. The co-operation between the ILO and the Colombo Plan will certainly provide the maximum of results with the minimum of efforts for the reciprocal benefits of the countries of the Colombo Plan region.

STATEMENT BY UNESCO OBSERVER

by

MR. F. J. C. PALA

UNESCO'S CURRENT PROGRAMME FOR THE PROMOTION OF EDUCATION AND TRAINING OF ENGINEERS, TECHNOLOGISTS AND HIGHER TECHNICIANS IN SOUTH-EAST ASIA

An earlier issue of the Journal of Engineering Education in South-East Asia (Vol. 3—1973) contained an outline of Unesco's Programme for the promotion of education for engineers, technologists and higher technicians. The following is an updated version of this outline based on the results of the 18th session of the General Conference of Unesco, held at Unesco Headquarters in October and November 1974.

The planning and support of this part of Unesco's programme falls under the Science Sector of Unesco Headquarters in Paris which has a Division of Technological Research and Higher Education with sections for Engineering Education and Education of Technologists and Higher Technicians. The current programme of this Division provides for a series of activities all over the world to promote technical education in particular:

(*a*) by encouraging international and regional cooperation for the development and improvement of the education of engineers, technologists and higher technicians;

(*b*) by promoting the reform and development of technological education to meet the needs of society, with special emphasis on the physical and working environment, through study of the structures, curricula, staffing, methods, costs and efficiency of the initial and continuing education of engineers, technologists and higher technicians, and by promotion of the exchange of information thereon; and

(*c*) by assisting Member States, upon request, in the execution and development of technological education institutions, centres of scientific instruments and other professional bodies appropriate to their needs.

LONG-TERM PROGRAMME FOR THE PROMOTION OF INTERNATIONAL AND REGIONAL CO-OPERATION

International Conference on Technological Education

An international conference on the education and training of engineering personnel is planned to be held in 1976, most probably in New Delhi. It is expected that there will be some 300 participants, comprising engineers, educators, practising engineers and higher technicians, manpower specialists, economists and government officials concerned with the planning of systems of higher technical education. This conference is a follow-up on the International Conference on Trends in the Teaching and Training of Engineers held at Unesco Headquarters in Paris in December 1968 which led to the launching in 1971 of a long-term programme to promote greater international and regional co-operation in efforts to improve the education of engineers and technologists on a world-wide scale. The objectives of the programme are the stimulation of reform in this sector of education so that it will contribute more effectively to national economic and social development. This involves consideration of curricula, social science aspects, structure, staffing, methodology, relations with industry, and provision of suitable facilities.

The New Delhi conference will review the progress of this long-term programme and examine the overall status of international and regional cooperation in this field. Particular attention will be given to analysing the experience of developing countries in creating or expanding their institutions for engineering and higher technical education, and to establish strategies for achieving and maintaining standards of quality and local relevance.

As part of the preparatory activities for the New Delhi conference, a regional seminar will be organized by Unesco to be held in 1975, outside of the Asian region, which will focus on the importance and role of the education and training of technologists and higher technicians, as compared with the education and training of engineers.

The Role of International, Regional and National Bodies

Establishment and strengthening of mechanisms for international, regional and national cooperation is an important aspect of Unesco's long-term programme for the promotion of education and training of engineers, technologists and higher technicians.

In its efforts to promote the reform of engineering education Unesco is continuing its co-operation with the Committee on Engineering Education and Training of the World Federation of Engineering Organizations (WFEO) and with regional groups and bodies.

In Asia the Association for Engineering Education for South-East Asia was established in Manila in October 1973 and the Association for Engineering Education for South and Central Asia was extablished in Kabul in March 1974. The aims of these Associations include the identification of problems in engineering education and training within their region and the rendering of assistance in finding solutions and providing services for improvement. It is hoped that these Associations will gradually expand their activities into the area of higher technician training. A special meeting of the Association for Engineering Education for South-East Asia was convened in Manila in April 1975 to discuss this matter.

It is expected that parts of Unesco's programme will be channelled through the above mentioned regional bodies so as to strengthen them, develop their links with institutions and national societies in their regions and reduce the isolation of engineering and technician educators in developing countries. The Unesco Regional Office for Science and Technology for South-East Asia in Jakarta and the one for South and Central Asia in New Delhi play an important role in these activities.

Emphasis is being placed on promoting the exchange of information through regional journals and newsletters and on strengthening national bodies concerned with the education and training of engineers technologists and higher technicians. Support will be provided for regional and national meetings and studies concerned with the reform of technological education.

Reform of Curricula

Work in the general area of curricula is being carried out in close cooperation with the Education Sector of Unesco. It is aimed to concentrate on three main aspects: the systematic design of curricula for the education of engineers, technologists and higher technicians so as to take into account both vocational needs of the graduates and modern knowledge of the learning processes; the social science content of curricula; and modern methods available for the teaching and training of engineers technologists and higher technicians. The emphasis is being placed on the particular needs of developing countries, especially for the development of courses in such fields as systems engineering, environmental engineering, the impact of engineering works on the environment, production engineering, agricultural engineering, and natural resources development. The co-operation of other agencies such as WHO, ILO, UNIDO and FAO is being sought on this.

An international working group on curricula design was establishd in 1974. Its work is oriented toward the methodology of curricula design, the relation of curricula design to the teaching and learning processes and the integration of interdisciplinary courses into engineering curricula. The integration into curricula of project-type activities and applied research useful to local industry will be stressed. In 1975 the needs of institutions in the developing countries for curricula suitable to local conditions will be analysed and a meeting of the international working group on curriculum design will be held to finalize a publication on "New Trends in Curriculum Design". The working group is also assisting in the synthesizing and editing of existing literature and information on curriculum design to be disseminated to engineering educators, through the regional and national groups.

Studies and Surveys on Manpower Needs

In cooperation with ILO, studies and surveys are being carried out with the aim of devising more accurate and rapid methods for prediction of national manpower needs for engineers, technologists and higher technicians. These studies will form part of the documentation of the international conference on technological education and will be published.

Information Service Facilities

The Unesco Secretariat is continuing to improve and strengthen its information service facilities to meet the needs of engineering educators in the developing countries and for the briefing of experts. Member States will thereby be kept informed of the innovative experience of other countries and of the efforts made to find solutions to common problems.

The work on the inventory of current world facilities in engineering education is being continued.

Environmental Aspects

An international working group on the environmental aspects of engineering education was established and this working group will hold its meeting in 1975 to examine the recommendations of the 1974 expert meeting on this subject and to prepare the follow-up action required. This work will also encompass the problems connected with working environments in industry, as well as those connected with preservation of the physical environment. Assistance will be given to appropriate regional associations in engineering education for dissemination of the results of studies and of information on innovations related to the inclusion of environmental topics in engineering curricula. The support from the United Nations Environmental Programme (UNEP) is being sought for activities in this field. Unesco cooperates currently with UNEP in the execution of several projects on the environmental training of engineers.

An experimental project on the environmental training of engineers is being established at the College of Engineering of the University of the Philippines, Quezon City. Another activity in this field in Asia is the two-week Asian Regional Workshop on the Environmental Training of Practising Civil Engineers at the Faculty of Engineering of the University of Malaya in Kuala Lumpur in May 1975. A report on this workshop will be published in the Journal of Engineering Education in South-East Asia.

Continuing Education

An international working group was established in 1973 to promote the need for adequate mechanisms for continuing education for engineers and technologists and to collect and disseminate information on problems in this field. The working group will hold its second meeting in 1975 to review projects, analyse their results prepare follow-up action and determine its contribution to the international conference on technological education. In co-operation with the Committee on Engineering Education and Training of the World Federation of Engineering Organization (WFEO) studies will be undertaken on the career trajectories of engineering graduates in developing countries. Support will also be given for a seminar in the Arab States in 1975 on the continuing education of engineers and technologists. All these activities will be closely co-ordinated with those on education-industry cooperation and with other engineering manpower studies being carried out by WFEO in collaboration with UNIDO and ILO.

Education-Industry Co-operation

A seminar for South-East Asia on education-industry co-operation in engineering education and training was held in Manila in October 1973. This was followed up in some countries by meetings of this kind on the national level.

Unesco established meanwhile an international working group on education-industry co-operation and this working group will meet in 1976. It will direct its efforts towards the need for educational institutions to contribute to the solution of local problems and to devise curricula, research programmes and service facilities to meet local development requirements. The effectiveness of institutional and industrial training for engineering personnel will be evaluated. A study on education-industry co-operation will be issued as a document. In the execution of these activities co-operation of UNDP and ILO is being sought.

Comparative Studies on Post-Secondary Technical Institutions

In view of the growing demand for higher technicians, a considerable number of intermediate-level technical institutions are opening post-secondary training sections to provide crash-training facilities for higher technicians which might subsequently be upgraded to university level. Unesco is engaged in making comparative studies on such structural changes in the countries where they have been most far-reaching, and the results of these studies will be published.

A seminar for the South-East Asian region on problems involved in establishing and developing higher technician training institutions was held at Tagaytay (Manila area), Philippines in April 1975. This meeting was specifically aimed to try to clarify factors which may indicate a wish for, or which may lead to an upgrading of a technical institution, including defining what is actually meant by upgrading. The report on this meeting will be published in the Journal of Engineering Education in South East Asia.

Staff of Higher Technical Education Institutions

In 1974 a symposium was held on the staff of higher technical education institutions in developing countries. As a follow-up on this meeting, a panel of experts will be convened in 1975 to prepare a publication containing concrete recommendations to Member States for overcoming staffing difficulties. This publication will be issued in 1976. In conjunction with the meeting of the panel of experts, a meeting of projects managers of UNDP-assisted projects in engineering and higher technicians education will be organized.

Cost Analysis of the Education and Training of Engineers, Technologists and Higher Technicians

A working group of specialists and staff of the Unesco Secretariat will establish a programme for cost analysis of the education and training of engineers, technologists and higher technicians, with a view to selecting the most efficacious methods of assisting projects under execution by Unesco. The results will be disseminated in the form of documents and will form the basis of a publication in 1977/1978.

ASSISTANCE TO MEMBER STATES

Advisory missions

Under Unesco's Participation Programme, assistance can be provided to Member States, upon request, in the form of advisory missions to assist in the planning, establishing and strengthening of their engineering institutions and to advise on systems of engineering education and curricula.

Advisory short-term expert and staff missions can also be provided to Member States, upon request, for evaluation of the local facilities for the training of technologists and higher technicians, for strengthening existing educational institutions and for assisting in the creation of new institutions. These missions will also give assistance in such areas as the maintenance of laboratory equipment and scientific instruments.

Study Grants and Travel Grants

As a means of establishing links between engineering institutions in developing countries, study grants can be awarded to the teaching staff of the institutions for short visits to similar institutions in the same region. Such missions aim to contribute to resolving common problems, to co-ordinating applied research activities on topics of regional importance and also to strengthening the regional associations concerned with engineering education. Study grants of this kind can also be provided to Member States, on request, to enable responsible officials and educators engaged in the education of technologists and higher technicians to study technological education and modern teaching methods in other countries.

Unesco will maintain close contact with institutions concerning the training of technologists and technicians for which UNDP-Unesco assistance has terminated. Travel grants can be provided for the national staff of these institutions to permit them to attend important meetings in their fields of interest and to maintain contact with their colleagues in other countries. A brochure describing successfully completed UNDP projects will be prepared.

UNDP Projects

The execution of UNDP financed projects in the field of education and training of engineers, technologists and higher technicians continues to be the major part of Unesco's activities concerning direct assistance to individual Member States. Significant ones in Asia are at present the following:

Engineering Education and Research and Training in Engineering Sciences

India — Postgraduate Education of Engineers
— Switchgear Testing
— Petroleum Utilization at Dehra Dun
— Turbo Machinery and Construction Laboratory Bangalore
— Central Electronics Engineering Research Institute
Khmer Republic — National Hydraulics Laboratory, Phnom Penh
Mongolia — Polytechnic Institute, Ulan Bator
Sri Lanka — College of Technology

Training of Technologists and Higher Technicians

Fiji — Diploma Courses Development
India — National Institute of Foundary and Forge Technology at Ranchi
Indonesia — Network of Scientific Services
Khmer Republic — Training of Engineers and Technicians

Papua New Guinea — Training of Laboratory Assistants

Singapore — Radar Simulation Centre, Singapore Polytechnic

Republic of Vietnam — National Technical Centre, Phu-Tho
Training of Higher Technicians

It will be seen from this outline that Unesco's Programme for the promotion of education and training of engineers, technologists and higher technicians covers a wide range of activities. The success of this programme depends on full and active participation of Member States in the region and Unesco would appreciate any comments and suggestions which might help to increase the effectiveness of this programme.

CONCLUDING SESSION

CHAIRMAN: MR. I. K. MCGREGOR

CLOSING SPEECHES

CHAIRMAN: We have disposed of the main business of the morning. There yet remains to hear from some of the participants and representatives of countries outside the region who have contributed to our discussions but some of them have not had much opportunity to do so but have listened with considerable attention to the discussions and would perhaps like to have an opportunity of making some comments but before calling upon them to do so I said it is customary for representatives of the participants to be invited to make their frank comments on the Colloquium and I have invited them to do so. I have invited the delegation from Sri Lanka, the delegation from Indonesia and the delegation from Malaysia to offer comments on behalf of all. There is not the opportunity for everybody to do so but I thought the selection was representative and perhaps might be helpful to us at later Colloquia. Now I would like to call on Mr. Paskaralingam of the delegation of Sri Lanka to open this part of the proceedings.

PASKARALINGAM: Thank you Mr. Chairman, I find that it is rather sad to part so early just as when we are building up very useful associations and contacts we find that we have to leave. Apart from that I like to put it on record that this Colloquium has proved to be of immense value. I think when I say immense value all the delegates here would agree with me we educators and administrators tend to develop certain fixed views over periods of months in our own countries. We think we know everything about technician education. It is only at Colloquia like these that we find that we actually know very little. I came with certain fixed views. Now I find that I have to revise my opinion on most of them. Every country, every delegate had something very useful to say on the subject of technician education. I did learn that different countries have different forms and patterns of education. The pattern of technical education takes varied nature, the strategies they adopt are different and peculiar to the socio-economic, the political and various other factors in each country. Some countries select students for technician training through a system of vocational education stream, some just select them after a number of years in general education with subject specialisation in mathematics and basic sciences but whatever the stream may be, whether it is through the vocational stream or through the general education stream or through general education coupled with occupational or prevocational studies I have learned that technician education is separate from all these and it is a specialised form of education. Over the years the Colombo Plan Bureau had through these Colloquia helped us to form definite views and understanding of technician education. Commencing with the papers submitted by the four experts at this Colloquia the discussions really got on to an interesting stage and I have to revise my opinion on many matters I had, so I am really thankful for the opportunity. We have learned about the role of the Colombo Plan Staff College. The Colombo Plan Staff College is really a creation of all the member countries. Therefore, it is left to the member countries to make full use of it. It is actually what we make of it. I gather that through the provision of individual country courses, courses devised specifically to suit the needs of individual countries, the Colombo Plan Staff College is planning to have its real thrust. I totally agree with that objective. I presume that the Colombo Plan Staff College will build up a group of experts in the regional member countries who will be able to give of their expertise at the times when country courses are being conducted. I would like to suggest that rather than having a large number of experts on the regular pay of the Colombo Plan Staff College, it would be really worthwhile to build up a pool of experts in member countries who could be called upon to participate at country courses in individual countries. I really envy the Colombo Plan Staff College because I can foresee in a matter of two to three years they are really going to build up a wealth of expertise by providing country courses, by spending little time in the different countries and studying the pattern of technician education and assist those countries in developing systems of technician education to suit the various socio-economic needs of those individual countries. I must thank the Chairman for giving me this opportunity. The Chairman has been very democratic, he has very dextrously handled this, especially the session which has just concluded. I can see it was really a difficult task for him to get an agreement on the Communique. I also thank the Co-Chairman who has been a wonderful host especially yesterday while giving us an opportunity to visit the University of Technology he also gave us a sumptuous feed. I thank the other organisers and I thank Malaysia for hosting us so very lavishly.

CHAIRMAN: I call upon Mr. Wahyudi of the delegation of Indonesia.

WAHYUDI: Thank you Mr. Chairman, Ladies and Gentlemen. I cannot talk any more. You know that my experiences are very small in technical education and this is the first time I go to a meeting like this Colloquium I mean outside Indonesia. So I think that this Colloquium is very useful for myself and my friends to increase our experience, knowledge and so forth. So I want to thank you very much for expressing especially to Mr. McGregor, the papers were very interesting and I think that before we recognise the technical education problem, first we have to recognise the development of our countries. There are two components one is technical education itself and the other is the development of socio-economy. That is why technical education in Indonesia is aimed at development planning, so, may be at the Colloquium, if possible, I want to explore much more the experience of the member countries.

CHAIRMAN: I call upon Mr. Murugasu of the delegation of Malaysia.

MURUGASU: Mr. Chairman, when you are the third speaker on the same subject the role is not an enviable one. Well I am in this difficult predicament and at the cost of repeating myself I crave the indulgence of this assembly to bear with me while I as a member of the host country do my duty. By and large I think during these five days of discussions we have come to realise that there are common areas where the problems are similar and there are also areas where the problems for instance in Fiji obviously different from the problems that are in India. But perhaps I should just mention a couple of points which might be useful as pointers for discussions in the future. These are actually some of the comments from my collegues, we feel that while there has been a lot of discussion on technicians but it has been confined largely to technicians in the manufacturing or industrial sectors. We sometime tend to forget when we talk of technicians there are also technicians in other areas as well particularly in agriculture, commerce, banking and so on. The second point that I thought would be useful to mention here is while we stressed and discussed the emphasis on training that is being done in most countries but we subscribe very openly perhaps on technician education and training but very little in fact has been discussed on the first aspect of education, technician education. In this respect I think we must also bear in mind that while we want to train technicians we also want to train them not only to be purposeful in promoting multiplier effect in industry but also educating them for life and this I think is an important area perhaps we can look into it in years to come. We are particularly grateful also because in Malaysia technical education and particularly technician education it is a very recent phenomena and you might say we are at the crossroads ourselves because we have yet to develop and identify and consolidate a fixed firm philosophy of approach towards technician and teacher training. This we feel is a very important aspect of planning because unless we ourselves know where we are heading and unless we charter our course it is quite possible that we may lead our technician ship aground, with disastrous consequences. So we are very grateful in fact and welcome the opportunity particularly in this crucial period of our planning and more so we have problems of convincing others particularly in industry and my good friend the administrators at the back and trainers in other institutions and I am sure this has afforded an opportunity to all of us as Mr. Paskaralingam put it to revise and restudy our thinking. We will in the future require the help of the Colombo Plan Bureau, the Staff College and we are grateful in particular to Dr. Chandrakant who has indicated his desire to look into the possibility of having a country course in Malaysia which is so close to Singapore and we shall take up the matter with our Ministry and other Ministries and perhaps we can work together in one field or another. Malaysia is particularly honoured because we have gained a great deal, especially, as I have indicated earlier, technician education is a very recent idea. We hope, however, that the recommendations, the deliberations and the conclusions that we have arrived at will be followed up with particular reference to Malaysia's needs especially as you have heard from the Minister's speech, we are planning and putting up a second polytechnic and we look forward to any help that we may be able to receive not only from the Colombo Plan Bureau and the Staff College but from other countries as well. It might perhaps not be out of place for me also to re-echo Mr. Paskaralingam's sentiments. He thanked the various people concerned with the success of this conference, I think I would like to congratulate the various people in particular the Colombo Plan Bureau for a well thought out, well planned and not too heavy programmes with visits, tours and so on. We thank them for their concern and secondly I think as the host country we should also record our thanks to Mr. McGregor, the Chairman, for the fine handling of the proceedings and the efficient manner in which he has brought this conference to a successful close. Modesty compels me, however, not to eulogise our own Chairman's efficient manner in which he made us stay an extra hour yesterday, but nevertheless I think I will be failing in my duty despite the fact that the Co-Chairman is a member of my own delegation, I would be failing in my duty and I am sure everyone of you will want me to re-echo those sentiments expressed by Mr. Paskaralingam from Sri Lanka and compliment Mr. Ainuddin for his contribution and the more so on the excellent thesis that he posed in his paper especially on the idea of the development of indigenous system which we have incorporated as a major issue in our Communique. I should also thank the Consultants starting from our great maha guruji Dr. Chandrakant the walking encyclopaedia or technical computor and for his brilliant exposition of the many problems connected with planning and so on. I think the success of this Colloquium is in no small measure due to his very presence. Mr. Parvez from Pakistan had also made a tremendous contribution and I think this consumate skill in which he wrote his paper speaks for itself. I must repeat the same sentiments with regard to Brigadier General Connelly's succint but a very juicy presentation of his paper. Mr. Mahendra and his small staff I think have played their part, the drafting was approved this morning without much discussion and the credit must go to Mr. Mahendra and his small staff for the excellent manner in which the presentation was done. I must also thank and congratulate the participation of all the members. This Colloquium cannot have been successful but for the participation of members and I think without exception everybody had something to contribute. I think a great deal was learned from the deliberations. We have learned from the experience of many countries some very serious problems such as of course the matrimonial difficulties that Fiji is facing and we heard from the eloquent member from Singapore of the natural evolution by which they have been able to get industrial co-operation and of course I hope more important for our own purposes and other purposes as well the lack of sympathy on the part of administrators to provide for adequate salary structure to technicians. I think we should also thank the observers in particular from ILO, Unesco, Commonwealth Secretariat, Mr. Cabot and Mr. Snelson for their contributions and last but not least the Observers who have been very vigilantly watching me from the back, I am referring to the members of the delegation from Malaysia itself. We cannot of course fail to mention the Secretariat staff and typists who have worked behind the scenes especially last night up to mid-night and I would be failing if I do not mention also the charming personality of Mrs. Freida at the back there and who has been, and who has successfully during the Seminar won over most of the members of the Malaysian delegation to her thinking in terms of Women's Liberation. I think I am not so sure whether her success was due largely to her own charm and personality and also because she gave us our per diem only this morning. I think the effectiveness, coming back to a more serious vein, of the Colloquium depends to a large extent, on the action that the countries are going to take when they get back to their own countries, how they act on the suggestions that have been posed and the recommendations that have been made and the follow-up action not only by all of us but also by the observers, by Dr. Chandrakant, the Colombo Plan Bureau and so on. One aspect I think which is not easily recognised is that in situations such as this the important contributions that have been done behind the scene are often not fully realised. And I think to a very large extent it is in this area where there is a great deal of exchange of ideas, cementing of friendship and occasions for humourous exchange of ideas and jokes and things like that and I on my part found this Colloquium and the Colloquium in Singapore very profitable in the sense that I have made very good personal friends and I am assured of a welcome when I visit their countries and I have also found it profitable in the sense that I have been getting presents. As you can see there is a pile of presents from Nepal sent to me through my good friend Mr. Pradhan whom I got to know in Singapore. So the Colloquium's profitable aspect also should not be overlooked. I think all of us will agree that we have gained a great deal from the deliberations in this Colloquium not only in exchange of ideas but also broadening our own knowledge and thereby updating our own status as technician educators. I think you would like me to thank the Colombo Plan Bureau for providing us the opportunity so that we were able to meet like this and it is our earnest hope, my earnest hope and I am sure it is yours as well that this Colloquium will be the forerunner of many more to come. I hope your stay in Malaysia has been very pleasant and enjoyable and when you go back to your own countries you would take the pleasant memories of our country and our people. I wish on behalf of Malaysia to apologise for my shortcomings and I would welcome anyone of you to visit our country again in the future. You have our addresses and I hope you will make good use of the addresses and let us know from time to time so that the friendship that we have forged here will not be broken. Finally, I wish you bon voyage and a happy pleasant and safe journey to your respective countries and, as we say in our national language, salamat jalang.

CHAIRMAN: Thank you very much Mr. Murugasu. It is customary now to invite the representatives of some countries outside the region to say a few words and perhaps offer their comments and also for somebody on behalf of the observers to speak. I call on the representatives of countries outside the region and perhaps Mr. Neil Richardson will lead off this part of the proceedings.

RICHARDSON: I would personally like to thank the Colombo Plan Bureau for the opportunity to attend the Colloquium as an observer. I have been somewhat reluctant to speak mainly because I do not have a background in technician training or technical education and therefore I do not feel I could make a vocal contribution to the Colloquium. I would like to say a couple of brief words. I would not like to go on record as not having opened my mouth at such an occasion like this firstly, there have been several references made to Australia during the course of the Colloquium and with particular reference to the comments made by the delegates of Papua New Guinea and Fiji. Firstly, the majority of the assistance provided by Australia has been in the form of training in institutions within our country. This has not always been the most successful form of training and by this I mean that training given does not necessarily fully relate to the conditions and requirements of nominating countries and because of this my agency which is the Australian Development Assistance Agency is responsible for all aid given by the Australian Government and placing increasing emphasis on in-country training and third country training within the region of South-East Asia and the South Pacific. As far as third country training is concerned Australia has been financing third country awards at several institutions which includes the Civil Aviation Training Centre, Bangkok, the South-East Asian Fisheries Development Centre in Bangkok and also the Ellis Chalmers Technical Centre. We have also been involved in technical training in Third Country for Australian Project personnel such as the training given to Khmer Republic and Indonesia under the Thai-Australian Road Project. We are hoping to increase the scope and range of third country training at technician level in time to come. The other area of training is the in-country technician training which has mainly been restricted to date to Papua New Guinea. Papua New Guinea has requested in-country courses for this year in underground cable construction and maintenance, safety officers and technical inspectors, mechanical plant operators and building contractors. We have developed a branch within our agency for the specific purpose of furthering training within the region as provided by Australia and we would welcome a fresh exchange of ideas, and correspondence with countries such as Fiji and Papua New Guinea, Laos in particular on the problem areas in technical training and education and where we could possibly assist. I would like to conclude perhaps by, if I am speaking on behalf of the observers, I would like to, I am sure they will all agree with me if I say that we have found the week a very useful and interesting one and that we have enjoyed being here as we are extremely grateful to the Colombo Plan Bureau and the Malaysian Government for the opportunity to attend.

CHAIRMAN: Now Brigadier Connelly is here in a dual capacity, I would like him to take off his consultant's hat and put on that of the Canadian Representative and give us the benefit of his experience of the Colloquium from that point of view.

CONNELLY: Thank you Mr. Chairman. I did not appear on the list as a delegate. I am the Canadian delegation. Perhaps you guessed from my queer accent. I would like to say that Canada as a founding member of the Colombo Plan has been interested in technician education and training right from the start by the provision of facilities, by providing instructors and fellowships and has lately taken an interest in third country training. I am sure that the Canadian International Development Agency will continue to assist in any way that it is requested to do so and I hope that the regional countries will take advantage of this. Taking off my delegation hat perhaps and putting on a personal one I would like to say how much I appreciate being invited to this Colloquium and to have had the opportunity to discuss the status of technicians. I have raised this question at Consultative Committee Meetings but failed to stir much interest. I was very happy to read the paper and listen to the presentation of Mr. Parvez on the subject which was very complete and it has also given me a great deal of satisfaction in learning how much the Staff College has been welcomed and the desire of each of the regional countries to make more use of it and I was very happy to see that Dr. Chandrakant was able to come here and not only advertise the College but give us the benefit of this wisdom that has been gained through many years of experience. I have been most interested not only in the Papers of Consultants but also in the Country Papers which gave me an idea of what was happening in each country and their recommendations. I will be very happy to make these recommendations to the Canadian Government. I think I ought to add my thanks to those that have already been expressed to the Director and to the Vice-Chancellor for the able way that they managed this meeting, to Mr. Mahendra and to Mr. Pathmanathan for the work they have done in previous and during this meeting and I wish I could name all the people behind the scenes who have made the meeting run so smoothly; the people who produced the papers; the Public Address system that has worked so well; those who made the hotel arrangements and those who conducted us on the various visits and tours. I thank them all. I am very happy to have had this opportunity to meet some of my old friends and I hope I have made some new ones.

CHAIRMAN: I would now like to invite Mr. La Serra to give us the benefit of his observations on behalf of the observers attending the meeting and those of international agencies as well.

LA SERRA: Mr. Chairman, I would just express the feelings of the observers from the Colombo Plan Staff College, Commonwealth Secretariat, ILO and Unesco. As observers our duty was to watch what was happening and I can assure that we have watched very carefully and we have not lost a single word of what all of you have said here. This Colloquium and other Colloquia of the Colombo Plan may be compared to just because we are in Malaysia, to a dredger of the tin mines; where at the end of the process the precious and valuable material just arrives in order to be processed to produce very valuable goods. This is more or less what we have done, you have done here and all these material is the final material resulting from this Colloquium will be conveyed to our agencies and organisations and be analysed in order to put up-to-date our information when we are preparing new programmes for technical co-operation. The Colombo Plan Colloquia have a great influence on our future programmes to adjust them to the real needs of the countries and not just to follow on the pattern that we followed before. In this Colloquium particularly many suggestions have arisen for innovation as Dr. Chandrakant has stressed and underlined, even in the kind of interagency co-operation. I cannot suggest, but I just want to recall the possibility of conveying through the Colombo Plan and the Colombo Plan Staff College the requests of the countries for international co-operation that may be more useful for the countries than individual requests. The purpose would be not repeating or overlapping in the activities of the agencies that are giving this contribution. And through the Colomho Plan, our agencies strive to work together as for instance, in the case I can say contracts had been made by us after putting in extra hours of work, which was useful. We are grateful and thankful for the opportunity to work together for the common objective affording the development of individual and collective human potential in the countries and we hope that our agencies will be requested to participate in all the other activities that the Colombo Plan is undertaking. It will be not only a pleasure but also a duty and a very useful co-operation and participation at the level of the practical activity. On behalf of our institutions and our agencies we are very grateful to the Colombo Plan and to the delegates of the countries for all the information and knowledge that they have transferred to us.

SADACHI: I do not have anything except what I said yesterday. Anyway I will report what happened in this Colloquium to our Government and it will be useful for our Government to promote technical co-operation more effectively. I am sorry I could not join your discussion because I am not an expert in technical education. I am just an embassy staff.

CHAIRMAN: Having been in a similar position to yours on many an occasion, I can only sympathise with you and wish you well in your reporting of this meeting, but I think perhaps that the Communique might provide a bit more guidance than perhaps could have been extracted at certain stages of our discussions. I think it would be appropriate at this juncture to call on the Co-Chairman, Mr. Ainuddin to say a few words.

AINUDDIN: Thank you Mr. Chairman. It is indeed a great pleasure to me to be with you all for the past five days and it is an honour for me to be able to sit with you all discussing the subjects which are so vital to most of us. I feel more honoured that I am included in such an eminent and distinguished group. May I take this opportunity to thank the Colombo Plan Bureau for the trust placed in me in electing me as the Co-Chairman for this Colloquium and I would like to record my thanks to the Director and our Co-Chairman, Mr. McGregor, for his guidance and co-operation. I wish to thank you all for your co-operation with me during the Colloquium and I would also wish to record my thanks to the excellent group of people in the Secretariat for the excellent work done by them. I am sure this Colloquium has benefited us in many ways technically or otherwise. Even if we have not learnt much at least I feel we have learnt to listen to the problems of others. I sincerely hope in our pursuit for technological advancement and development we shall not forget another aspect of development that is the development of the human being spiritually. I hope your stay in this small country of ours has been a pleasant one and may I take this opportunity to wish you all the best of luck in your attempt in upgrading the status of the technician. I conclude with the hope that we will meet again soon and I say *au revoir*.

CHAIRMAN: Thank you very much Mr. Ainuddin. At this stage of the proceedings I think unless anybody has got anything else to say I would commence to declare the proceedings closed. But before I do so I should like to acknowledge our gratitude to the Government and people of Malaysia for extending the hospitality they have done to the Colloquium. In particular I would like to thank Dr. Mahathir bin Mohammed, Minister of Education; Tan Sri Haji Hamdan bin Sheikh Tahir, Director-General of the Ministry of Education; Tuan Haji Lokman bin Musa with whom we conducted the initial discussions relating to the arrangements for the Colloquium and also officers of the Ministry of Education and other Ministries who have attended from the Government of Malaysia and to Puan Freida and her staff in the Secretariat for bearing with us in the initial stages of the discussions and extending themselves to a very great extent to meet some of the importunate demands that the Bureau may have placed on them. Also I would like to thank my own colleagues, Mr. Mahendra and Mr. Pathmanathan from the Bureau for the signal services that they have rendered not only to this Colloquium but also to others and the fact that the traditions that have been established at previous Colloquiua have been so firmly upheld at this one is due in no small measure to their efforts and to those of the officers of the host countries who have so willingly given of their time and trouble to make these occasions the success that they have invariably been. This is the first experience that I have had of one but before I embarked on this rather perilous sea I studied at some length the proceedings of the other Colloquia and derived no small benefit from that effort. I would also like to thank the Consultants and the Canadian Government for making the services of Brigadier Connelly, my predecessor in office at the Bureau, available; the Staff College Governing Board, for making it possible for Dr. Chandrakant to come and be with us, as the Malaysian delegation has so quickly plagiarised the sobriquet that we bestowed on the guruji last night at the drafting Committee. Anyway before Mr. Bashir Parvez left last night he asked me particularly to convey his salutations to all the participants and to the Chairman and Consultants and the other colleagues, as it was the only opportunity he had to get a direct flight to Pakistan and he availed himself of that opportunity somewhat regretfully. Mr. Ainuddin, I would also like to take this opportunity of expressing my own gratitude and on behalf of the other participants in the meeting to you not only for the presentation of your paper but also for the support and advice that you have given as Co-Chairman. This is perhaps a precedent in the running of Colloquia because usually the whole burden has fallen on the Director of the Bureau to conduct the proceedings at others but I thought that in making arrangements for this particular Colloquium it may be advantageous to invite the Governments of Malaysia to nominate a Co-Chairman as we have done at other meetings sponsored by the Colombo Plan in association with member Governments. We did this at the Seminar in Dacca with signal success and I think you will agree that the arrangements have worked admirably and provided a visible demonstration of that peculiar phenomenon which is known as shared responsibility. I think that with due deference to Dr. Chandrakant it may go along with other aphorisms such as the marxist doctrine of the law of increasing misery or religion being the opiate of the people having just descended from the Genting Highlands attendance on the Seminar on "Narcotics Control". I crave the indulgence of the Colloquium for perhaps attempting to tranquilize it at this stage of the proceedings. I should like also to thank the participants without whom the Colloquium would never have got off the ground and I would also like to congratulate your respective governments for the felicitousness of their choice of representatives at this Colloquium. I think that we have been singularly fortunate in having people of your stature, I would not say status because it also has overtones of something that I remember from a very long while ago about "God bless the squire and his relations and keep us in our proper stations". It is something that is entirely foreign to the attitude of the country from which I come and I hope it is from yours too but I feel that the contributions which you have made to these proceedings have been valuable, thoughtful and most ably presented. And I would like to thank you for the time and trouble that each and every one of you have devoted to making this Colloquium the substantial achievement which I believe it will prove to be as Mr. Paskaralingam remarked and other speakers of this morning's session once the captains and the kings have departed from this the real works begins but if we can use our good offices in commending the wisdom which we hope we have distilled at this meeting to our member governments I think much will have been achieved or may be about to be achieved and I feel that as others have remarked that the lessons that we have learnt here and perhaps knocked some of the corners of our firmly cherished illusions may have done us all some salutary benefit. Anyway that is a speculative comment and I do hope that it will bear fruit. I should also like to thank the people who are in charge of the publicity arrangements, the Malaysian T.V., Radio and Press for the coverage that they have given this Colloquium and those participating in it. Also I should like to thank those who are in charge of the industries which we visited, the institutions which we have visited and are perhaps to visit this afternoon. The hotel management I would also acknowledge the help that they have given us in the physical arrangement for the Colloquium and all those who have helped in other ways, I should like to record the thanks of the Bureau and of my Co-Chairman for all the efforts that they have put in to bringing this to a successful conclusion. I hope I have not neglected anybody in my acknowledgments of the help we have received but it is quite sincere and I feel that everybody has contributed to the Colloquium and I *hope that its results would not be* sort of pigeon holed like so many recommendations are these days because of their number and perhaps irrelevance to practical problem which we face on our return home. Lastly, I should like also to acknowledge the help and advice that the members of the Drafting Committee offered last night an index of their practicality I think is in the nature of the amendments that were made to the draft which was before you this morning. Thank you all very much.

TEXT OF COLLOQUIUM COMMUNIQUE

1. The Sixth Colloquium on Intra-Regional Technician Training sponsored by the Colombo Plan Bureau, through the courtesy and assistance of the Government of Malaysia, was held at the Merlin Hotel, Kuala Lumpur, from 21 to 25 April 1975.

The Colloquium was attended by 39 delegates from Bangladesh, Britain, Canada, Fiji, India, Indonesia, Iran, Japan, Republic of Korea, Laos, Malaysia, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand and five observers from Australia, Colomho Plan Staff College for Technician Education, Commonwealth Secretariat, ILO and Unesco. Mr. I. K. McGregor, Director, Colomho Plan Bureau and Encik Ainuddin bin Abdul Wahid, Vice-Chancellor, University of Technology, Malaysia, Kuala Lumpur, served as Co-Chairmen of the Colloquium.

2. The Colloquium was inaugurated by the Honourable Dr. Mahathir bin Mohamad, Minister of Education, Government of Malaysia, who stated that many of the problems of under-development in countries endowed with rich natural and physical resources were due to the lack of proper development and utilisation of human resources. The Colloquium was of great importance to Malaysia, which had launched a massive educational and training programme at all levels to meet its rapid industrialisation. He expressed the view that it was through inter-regional and intra-regional co-operation that the countries of the Colombo Plan region could achieve economic development.

3. Discussion at the Colloquium centred around the following papers prepared by consultants:

(i) **"The influence of technician education on economic development"**

by Encik Ainuddin bin Abdul Wahid, Vice-Chancellor, University of Technology, Malaysia, Kuala Lumpur.

(ii) **"Improving the status of technicians"**

by Mr. Bashir A. Parvez, Director of Technical Education, Government of the Punjab, Lahore.

(iii) **"Improving the status of technicians"**

by Brigadier General A. B. Connelly, Colombo Plan Adviser (Project Development), Foreign Economic Relations Department, Rangoon.

(iv) **"An analysis of major issues involved in planning and implementation and identification of main areas of research and innovations"**

by Dr. L. S. Chandrakant, Director, Colombo Plan Staff College for Technician Education, Singapore.

4. In addition to the discussions which ensued after the consultants had presented their respective papers, a session was devoted to the discussion of important questions which arose out of those Papers. The substance of these discussions is embodied in the recommendations which follow.

5. The Colloquium recommends the following for appropriate action by member governments:

Development of Indigenous Systems

(i) The countries of the region should develop systems of technician education and training to suit their particular socio-economic needs. Special care should be taken to ensure that the systems in each country is rationalised and that all the programmes of technician education and training are co-ordinated within an institutional framework such as a fully representative National Council for Technician Education and Training. Each country should aim at developing a system which should become progressively self-sustaining. The transfer and adaptation of technology relevant to local needs would thus be facilitated as would the development of indigenous technology.

Impact of Technician Education and Training on Economic Development

(ii) Formal technician education and training should be preceded by opportunities for exposure to basic scientific and technical studies at the secondary school level along with suitable vocational guidance. Technician education and training should be directly related to the requirements of all sectors of the economy such as manufacturing, agriculture, health, education, commerce and banking, as projected in economic development plans. Innovative and creative approaches should be encouraged among technicians. A broader educational background would also develop their ability to communicate and thus enable them to transmit their knowledge and skills to others.

Crash Programmes

(iii) Crash programmes for the education and training of technicians may be undertaken by countries in the region to meet their immediate requirement, without disregarding the parallel need to develop their regular long-term programmes. Those trained under such programmes should be afforded opportunities for further training to improve their knowledge and skills and to maintain standards.

Status of Technicians

(iv) The Colloquium recognised that whatever status may be accorded technicians depended on those cultural and social values current in the society in which they work. That status could only be enhanced if society were to accord technicians a value commensurate with that of the contribution which they might make to its progress. Notwithstanding this, as the technician has an important functional rôle in the process of economic development, his status should be improved. In the context of conditions prevailing in the region, the following measures might be taken:

(*a*) offering adequate incentives in the form of realistic wages and favourable working conditions to attract talented persons to such jobs.

(*b*) affording technicians who have shown promise opportunities for broadening their education and improving their technical competence and prospects of career advancement.

(*c*) making institutional arrangements (such as the establishment of a National Council referred to earlier) which would facilitate the establishing and maintaining of adequate standards for appropriate accreditation.

(*d*) promoting the formation of professional associations of technicians having their own charters of incorporation and publishing their own journals.

(*e*) inculcating in the technician a sense of pride in his work and in his ability to perform well.

Role of Industry

(v) Industry needs to be involved at all stages of planning and in developing technician education programmes. There should be active co-operation between institutions and industry and the concept of shared responsibility should be a cardinal feature of any system of technician education and training. There should be a two-way flow between institutions and industry which would facilitate a free exchange of ideas as well as of students, teachers and industrial personnel. The co-operation of industry might be obtained by offering incentives, by persuasion or by legislation and the approach should be multilevel, that is, local, regional and national.

Research and Innovation

(vi) Research should be undertaken to ensure that technician education and training are related to the socio-economic needs of the Colombo Plan region. These needs pose practical problems both in individual countries and in groups of countries. Research into those problems which arise in the latter should be undertaken, as a matter of priority, by international organisations and the Colombo Plan Staff College for Technician Education. The subjects suggested for research are:

(*a*) Technician Teacher Training.

(*b*) Curriculum Design and Development.

(*c*) Educational Technology.

(*d*) Technician Institution—Industry Co-operation.

(*e*) Evaluation.

(*f*) Case studies of situations arising out of Systems of Technician Education and Training.

(*g*) Follow-up studies of graduates of Technician Education Institutions.

(vii) Innovations are of special value and relevance in the context of limited resources and other problems inhibiting the development of technician education and training. The following problem areas, common to many countries in the region, call for innovative approaches:

(*a*) Integration of Theory with Practice.

(*b*) Curriculum Design and Development.

(*c*) Educational Evaluation.

(*d*) Teaching Learning Processes.

Non-formal Technician Education and Training

(viii) Steps should be taken to develop non-formal technician education and training (on-the-job training, correspondence courses, etc.) in co-ordination with the formal systems, to maximise human resource development.

Requirements of the smaller countries

(ix) The smaller countries of the region have problems related to technician education and training which are in some ways unique and call for the understanding and assistance of member countries. In the Colombo Plan context, such assistance could be provided more meaningfully by affording them additional opportunities for intra-regional training and by extending resources and advisory services to create an adequate infrastructural and institutional base. The Staff College should be requested to pay particular attention to these problems and examine ways in which solutions to these might be sought.

Appendix I

MEMBERS OF THE ORGANISING COMMITTEE

Chairman — Mr. Haji Lokman bin Musa
Documentation — Mr. Bahaudin bin Marji and
Mr. Hanafi bin Kamal
Technical — Mr. Shaari bin Isa
Reception — Mrs. Freida binti Datuk Mohd. Pilus
Finance — Mr. Mohd. Nor bin Othman
Visits — Mr. Awang Zaki bin A. Bakar
Secretariat — Mr. Ramli bin Kamaruddin
Mr. Modh. Sam Sam bin Abdul Wahab
Mr. K. S. Maniam
Information — Mr. Johari Haji Hussein
Transport — Mr. Yusof Mydin
Registration — Mr. V. Vellapan
Colombo Plan Bureau Co-ordinator — Mr. S. Mahendra
Colloquium Co-ordinator — Mrs. Freida binti Datuk Mohd. Pilus
Master of Ceremonies — Mr. Asa'ari Noh

MEMBERS OF THE DRAFTING COMMITTEE

Mr. Ainuddin bin Abdul Wahid
Mr. J. L. Cabot
Dr. Aminul Huq
Mr. Koh Watt Seng
Mr. Ananta Krukeo
Mr. S. Mahendra
Mr. Meli Maisema
Mr. I. K. McGregor
Mr. V. Murugasu
Mr. M. S. Srinivasan

Background Paper

RESEARCH AND INNOVATION IN TECHNICAL EDUCATION*

by

SHRI Y. SARAN
Principal
Technical Teachers' Training Institute
Bhopal

After independence we have made a phenomenal progress in technical education. The initial stage of the expansion of resources, which is so crucial to a developing country, has been completed. We could easily be proud of our resources and look back with satisfaction to our performance in the difficult situations of the last two decades. The Ministry of Education, Government of India, is taking positive action to improve the quality and effectiveness of technical education. The State and the Central Governments have undertaken a large number of hold and promising programmes. The educational scene today is marked with a subtle optimism. Sandwich courses, diversified courses, implementation of the quality improvement programmes establishment of curriculum development centres, summer schools, establishment of teacher training institutes, etc., are some of the strong evidences of our progress towards better technical education. Although the client system is large, and so geographically dispersed,teachers are now receiving pedagogic training through short courses and extended programmes. The curriculum development centres have produced first generation curriculum materials including lesson plans, student manuals, supplementary readings, worksheets and demonstration sheets. In short, there is presently under way a rather substantial effort to improve the relevancy of curriculum content and to place superior material in the hands of technical teachers. It is in this context that one feels the absence of well organised educational research and our lack of capacity to innovate. Promoting educational researches and building up suitable potential to innovate is the most immediate need for improvement of technical education. It is the setting up of these activities and organising this potential which will determine the success and effectiveness of technical education in the next decade. The atmosphere, at present, is beyond doubt pregnant with ideas for research and enthusiasm for innovation. The process of envisaged change could not be completed without innovation and therefore it requires all the resources and attention that we could command in addition to our talents and specialists. We should try to cash in on the existing enthusiasm and awakening as well as fulfil the need in the educational system by suitable innovation and research.

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* This paper was presented at the Colombo Plan Seminar on "Technical Education and Training" held in Madras in 1972. It was not presented at the Colloquium, but was intended to provide background reading in preparation for it.

I would first like to deal briefly with the aspect of research in technical education by offering some suggestions and by establishing a case for its promotion in our country.

Educational Research

If education is to be treated like an industry, as it correctly is, research and development activity is vital for its being effective and purposeful. An industry declines in profitability and education loses its usefulness without research and innovation. Unfortunately our record of research in technical education is rather too unimpressive. We can count studies, surveys or researches on our finger-tips, which is not befitting a huge system of technical education like ours. Lack of research is normally responsible for the decay of the system. Many of the present faults in our educational system are due to lack of rational data based on studies, surveys and researches. We should examine seriously what could be done about promoting some researches and develop a system of basing our decisions on their findings. This will help the establishment on a self-correcting system with checks and remedial measures.

Dr. L. S. Chandrakant, Educational Adviser (Technical), Government of India, Ministry of Education, puts the following questions in his article which appeared in 3rd Indian Year Book of Education— Educational Research.

(i) Are we getting our money's worth?

(ii) Whether our institutions are conducting their affairs well?

(iii) Whether they are meeting the demand of industry for technical manpower not merely in numbers but in quality and type of engineers and technicians trained?

(iv) Whether they continuously improve their performance and adapt themselves to scientific and technological advances?

(v) Whether their curriculum offerings, faculty competence and physical plants reflect a vigorous system of technical education and training?

(vi) Whether technical institutions are effective as an instrument of social change and economic progress and so on?

Answering these questions require years of organised research. The questions are relevant and their answers are needed by all teachers, administrators and policy framers.

Educational research assumes a priority in view of the drastic changes taking place in technical education. We have to ensure correctness of decisions in the change which should come scientifically and must be evaluated. It is not enough to merely change, but the change should be with a purpose and with proper goals. Research helps us in arriving at those goals. The present optimism in polytechnics; the enthusiasm of the teachers to improve it; the national concern and support that is being given to it; could all be made doubly beneficial if we support our common-sense and judgement through findings of educational research. All we have to do is to be convinced about it and be determined to initiate it at the earliest possible opportunity. It also needs that we fix up our initial and long range goals and pursue them with vigour and determination. I am confident that this will give a rational meaning to the developments in our education, give the goals and methods of education to the teacher and will enable the institutions to serve industry better. One could ask me which researches I am talking of and how to go about it in our present situation? What priorities are needed in establishing a proper system for research in our country.

Research and Its Environment

Research based on scientific tradition has had a long history of providing a means of solving a wide range of problems. Research has moved during the century from the periphery to the centre of our social and economic life. Down through the decades a succession of scientists have passed the road to social betterment. The efforts have provided people with better quality, quantity and variety of food; more attractive and diverse clothing and innumerable comforts and conveniences that enlivens their life. On every front scientists have attacked drudgery and disease. As a result of their efforts people live longer, possess better health, enjoy more leisure see more of the world, endure less suffering and experience less arduous labour.

Having observed a period of astonishing advances and having become increasingly indebted to science we should have the greatest respect for research work. But many persons in our country do not have an intelligent understanding of the nature and value of research, specially educational research. They have developed attitudes that impede scientific progress. Because of vested interests in the status quo or from a fearful distrust of new ideas or developments, some individuals and groups do not want to change their traditional pattern of thought. To them change is unnecessary and undesirable, hence they rudely reject researchers who present ideas or innovations that depart too far from prevailing practices or beliefs. Because of inertia, ignorance or belief some people even ridicule the efforts of research workers. This problem becomes serious when the management attitudes towards research are not very enthusiastic or when it receives the last priority in allocation of funds. The lack of any organised educational research in our country is due to lack of proper attitude or efforts on part of educators and management.

Tremendous impetus has been given to the educational research movement during the last decade in developed countries, where substantial financial support had been granted to educators. In our country, we spend about one hundred crore of rupees on technical education. The expenditure on research could easily be to the extent of five percent as compared to the normal research and development expenditure of a large industry. We should, however, make a beginning by at least spending one percent of our expenditure on educational research.

The people in education apply the term research to a wide range of activities, from the information collection of data for the purpose of solving administrative problems to work undertaken by scientists over a lifetime. In the field of education we identify research with a better understanding of the teaching-learning process, and the conditions under which it is most successfully carried on. Educational research in the words of Professor Robert M. W. Travers represents an activity directed towards the development of an organised body of scientific knowledge about the events with which educators are concerned. The scientific goal of educational research is to discover laws or generalisations about behaviour that can be used to make predictions and control events within educational situations. This helps in planning educational procedures and practices.

Judging its need from yet another angle, a progressive educational system and institutions under good administrative leadership must continuously evaluate student progress. This evaluation should result in an increased knowledge concerning the ways in which pupils learn, what could be taught and how to go about it. The old expression "it was good enough for my father so it as good enough for me" is no longer appropriate for a society in which technological development of each day tends to make obsolete many of our previously established theories. The present rate of knowledge explosion and the challenge to the teachers for better education by teaching more in lesser time makes its need more crucial. Educational research appears to be the most likely method of keeping up with events in our present dynamic society. The outcome of research should produce diversified benefits for educational process, from the personal on-the-job improvement of an individual teacher to the establishment of an entirely new body of theory of thought.

The broad interpretation of the objectives of educational research could be so comprehensive that it would become meaningless. Therefore, our concern in initiating research should be limited to specific goals of educational research activity.

Forms of Research

The research in the various areas of technical education can take many forms. It could be "fundamental research" which is a formal and systematic process of carrying on the scientific method of analysis and generalisation. It could increase understanding of the educational process and the conditions under which it is most successfully carried on. It could be "action research" which employs the spirit of fundamental research and focusses attention upon the solution of problems, rather than upon the formulation of theories. This is an on-the-job type of problem solving used by teachers and administrators in general to improve the quality of their institutional practices. Stephen McCorey a leader in the field of action research states: "I have lost much of the faith I once had in the consequences of asking only the professional educational investigator to study the schools and to recommend what they should do. Incorporating these recommendations into the behaviour pattern of practitioners involves some problems that so far have been insolvable. Most of the study of what should be kept in the schools and what should go and what should be added must be done in hundreds or thousands of class-rooms and thousands of American communities. The studies must be undertaken by those who may have to change the way they do things as a result of the studies. Our schools cannot keep up with the life they are supposed to sustain and improve unless teachers, pupils, supervisors, administrators and school patrons continuously examine what they are doing. Singly and in groups they must use their imagination creatively and constructively to identify the practices that must be changed to meet the demands of modern life, courageously try out these practices that give better promises and methodically and systematically gather evidence to test their truth. This is the process I call action research".

Yet another recently developed specialised field of research is 'instructional research' which deals with investigation of those variables and conditions that appear to have direct applicability to the effective design of technical instruction. Its rationale is that there should be extensive research focussing upon learning tasks and learning conditions before instructional personnel will be able to apply such knowledge to the design of instruction for representative humantasks. This research is centred on events of instruction, i.e. the distinguishable conditions external to the learner, each of which may be arranged independently by the instructional designer and each of which may be considered as accomplishing a different subordinated purpose of the "single lesson" instructional process.

Problems for Research

Problems to be studied are plentiful. Among the perennial educational problems for which no final answers have as yet been obtained are: grouping for instructional purposes, selection and organisation of curriculum content, development of slow learner, utilisation of full abilities of gifted learner, learning theory, teaching effectiveness and its evaluation, class size, methods of presentation and problems dealing with school finance, facilities and community environment.

I would not suggest a large scale involvement in the abovementioned topics for initiating educational research in our country. There are enough theoretical data together with information through researches already conducted and through published results. I will press for researches in the actual instructional process. Even with the best curriculum design and high quality instructional materials the teachers' behaviour in the class-room or laboratory is the most important single factor in instructional effectiveness. Unfortunately we have very little reliable and valid information about instructional practices in technical education in India. Systematic studies are needed to describe actual teaching performance, interaction patterns, and other aspects of instructional milieu. Many innovative proposals have been forthcoming from educators, high powered committees and consultants but thus far there has been no systematic experimentation to determine the effectiveness of those recommendations.

Another important area for research is in curriculum building. The recently adopted developmental approach to curriculum building is receiving substantial support from the Government of India. We are bringing about major changes in curriculum. Systematic study to arrive at its structure leads us to the taxonomy of educational objectives and the behaviourally stated objectives. A lot of study is also needed to evaluate the first generation curriculum material. Without initiating such researches we shall not be able to take advantage of this new area of curriculum innovation in our country. We require proper job analysis, task analysis and surveys for occupational pattern in the country to consolidate the gains through this curriculum innovation.

Other problems requiring urgent attention of researches are in the field of evaluation techniques; effectiveness of instructional material and text-books; relations between industry and technical institution; use of library and students learning habits. These items will require years of research before we could say with precision the corrections needed in the system on a rational basis.

The Technical Teachers' Training Institute, Bhopal, has realised these problems and has started some researches in an elementary way. We have conducted a survey for job analysis in the Western Region, which is the basis for our curriculum development. We have initiated some short-term courses on the methodology of research in technical education which were largely attended. Our faculty has started some small projects on instructional research and we hope to develop the know-how and confidence for initiating large-scale research projects which would be useful to the educators in the country. A proposal for establishing a centre in instructional research in technical education has also been submitted to the Ministry of Education, Government of India. A series of such centres in the country are immediately needed for initiating research activity in technical education. Our efforts in curriculum development, preparation of instructional material, development of equipment and identifying appropriate teaching methods require substantial innovation and research. We have started the research and innovation in an humble way. A large number of teachers, about 300 teachers will participate in the curriculum development and material preparation activity which makes our process of curriculum innovation a process of teachers in the polytechnics. We hope to give all those interested in innovation and research, something concrete in the years to come. We are presently struggling to establish a proper system and to develop a proper methodology which shall be suitable to our country. I plead for support for initiating research and innovative activities in technical education in our country and would urge for a very substantial support and positive action in the next five years. If the educators and administrators accept and understand the need for research it will be a step forward. Then we shall need determination and a sense of commitment to further them. I am sure that this will ensure proper growth of technical education in the country.

Innovation

There are no qualitative data about how scientific and technical knowledge is used as a basis for innovation. We can tacitly accept the general assumption that innovation, *per se* is good, beneficial to economy, education and industry and that a deeper understanding of the process is needed to further it. Beyond this widely accepted proposition important differences of opinion would emerge. Discussion could range broadly from the philosophical to the nuts-and-bolts innovation.

Innovation in education like technological innovation is often misunderstood to mean primarily highly creative, radically new inventions of great importance. In practice, however, innovation is more often the result of recognising and adapting an idea than of inventing a brand new one. In an innovation the degree of creativity is not necessarily relevant nor are the economic consequences that important.

Before proceeding further I must submit a few sample definitions that I accept and unveil some concepts basic to an understanding of the innovative process. First of all I believe in innovation. With Schumpeter, I view innovation as the central fact in a society, as a powerful engine which drives the economy forward and upward. Without adequate innovation, I believe we face declines. Secondly, I believe there is a high degree of co-relation between innovative performance and long run profitability and survivability. I like the definition of innovation as "the setting up a new production function" with the statement that innovation "combines factors in new ways". This definition is sufficiently broad-based to be generally accepted.

Innovation does not involve a single act, it is not just a flash of inventive genius, it is not just the development of a new gadget, a new system, a new manufacturing technique. Rather it is all of these things acting together in some related way. In earlier times the specialist acts in each of these areas were quite frequently widely separated in space time and organisation. It was difficult to see the innovation process as a whole. Today we are learning that technological innovation is a total process. Whether it exists consciously or not as a total process, is besides the point. We should understand it as a process, because through understanding we get adoption and action.

What are some of the attributes of the process? All of the parts of the process depend upon the individually creative acts and collectively co-operative actions of people. It would be correct to phrase it as a people process, with a purpose. If it is a people process then we are dealing with creative people. This poses an important problem, how you get people to be creative to specifications.

Innovations need not be started with huge ambitious programmes. Cumulative effect of many small innovations is greater than a few large ones. It is not the lone innovators that are prime contributors to the process of change, but an army of technical employees and educators whose daily job is to improve gradually the quality of education through innovation. The sum of their attitudes determines the rate and quality of innovations and the capacity of their institutions to innovate. Prof. John Stedman emphasises that the innovative process has no self-starter, nor does it have a built-in guidance system, nor is it inherently powerful enough to overcome all the barriers in its path to success. For innovation to occur, somebody must direct the process towards some objectives.

There is a general sense of dissatisfaction about the innovative process in our country. It is proceeding slowly in education compared to a faster pace in industry. In our country today's innovations are based largely on 30 year old science. The lag between discovery and innovation is too wide. This is a serious situation. Goldman asserts that the time lag between research and utilisation is in fact being compressed so fast that soon the market place may have an innovation before the scientist has published his theory. A rapidly growing economy like ours should encourage innovations and encourage investment in new ideas. It is vital for its growth and development.

Institutions' Role

The primary characteristics of good management is recognition of the importance of successful innovations. The process of innovation starts with the management which should provide goals on which all innovators can focus their efforts. These goals must be defined broadly enough to provide adequate personal satisfaction but narrowly enough to be operational. It is the managements' job not only to define goals but to ensure that every man in the system knows what these goals are. For in the final analysis the creative ideas are coming from people, the specialists. If they do not know what your goals are, do not be surprised with poor results. Furthermore, the goals must be challenging enough to ensure total commitment from these specialists.

A sympathetic and encouraging national as well as institutional climate is very important for innovations. But equally important, if not more so, is to accept and encourage excellence, boldness and understanding at the front-line of innovation where the action is. Neither the provision of incentives nor the removal of barriers can be an adequate substitute for it. No element of society is properly organised to tackle the problem of encouraging excellence and boldness. The difficulty is compounded when those high up who now perform essential parts of a function refuse to change or even modify. These vested interests constitute by far the most serious barriers to important innovations.

How could an institution organise itself for more innovations in a limited object. I suggest that proposed innovations should be ranked according to cost, benefits and risk. The management should support as many as resources permit. The objective of this exercise is not just to avoid bad ideas, it is to pick out the very best ideas. Improperly screened innovations are likely to fail for a variety of reasons. Sometimes people might try to solve problems not worth solving.

"In order to discover anything you have to be working on something". It is perhaps better to be working towards poorly defined objectives than not to be working at all. The great value of doing something is that it generates more research outputs, information and innovative ideas that might be used, perhaps, by somebody else. Because the process of innovation reinforces itself, it is important to keep the innovative engine running.

Communication is Important for Innovation

Innovations result from the utilisation of technical information including research outputs. To transform research and technical information into specific innovations requires a certain amount of organised effort. We must recognise that new scientific and technical information stimulates innovation by defining hitherto underfined needs and problems. With new information you discover that there are problems you did not know you had.

Before the research outputs and other technical information could be transformed into innovations they have to be somehow transferred to the people who might utilise them. Harvey Brook suggests that transfer occurs along two dimensions-vertical and horizontal. In vertical transfers the general is transformed into specific; science becomes technology and technology finally becomes hardware. Horizontal transfer occurs when scientific or technical information generated in one institution is borrowed by the other to meet its own needs. The vertical transfer normally takes place within an institution and horizontal transfer takes place amongst institutions. The horizontal transfer depends heavily on information communication among people rather than on formal systems. Outside information is an important basis for innovation. Another factor is that little transferred information will be utilised unless there is a purpose for doing so. How outside information gets to its user is a question which requires an organised effort and attention.

Communication is another effective medium to promote innovation. Face to face conversations are a most effective means of communication. Memoranda, reports and even telephone conversations are far less effective. Specialists must be able to talk to each other directly on their own levels as equals. The communication of research outputs must not be blocked by prestige factors and formalism. A good communication system does not just happen accidently; management must take deliberate, specific action to devise and keep open necessary communication channels. In our situation the communication channels are alarmingly poor and therefore need concrete action.

Motivation for Innovation

Motivation for innovation is an area in the process of innovation that warrants study. It is clear that many who spark the innovative activity relish it. Personal fulfilment derived from creating something is an important incentive to run the very real personal risk that goes with the responsibility for innovation. For most men personal fulfilment, "hero's life" has a strong appeal whether or not great personal monetary rewards also attend successful innovation. This is specially when they are given latitude in choosing and developing innovations.

What we all want to know is how people can be motivated to be creative both individually and creatively, towards common purposes. How can we produce self-motivation, because this is the only kind that really counts, produces total commitment and satisfies the "hero's life". How can we develop goals with challenge and reward to produce the self-motivation? Can we build a system in which relevant innovations come naturally? We can at least try.

Improvement of Low IQ

If we define "innovation question" as the proficiency to innovate then most of our institutions would be having a low IQ. What can we do to improve the IQ? Some ideas are given below as a starting point:

In low IQ institution the focus should be on an individual. As the institution begins to innovate its IQ begins to rise.

Elevating the usually low IQ requires presence of at least one individual who will seize the opportunities for innovation and who will push, pull, cajole and threaten the necessary people and commandeer the necessary resources to exploit such opportunities.

Low IQ needs a substantial allocation of resources for permitting innovative activity.

Topically, the innovator in the low IQ environment can be said to "satisfice" rather than optimise. Satisficing finds the innovator emphasising those innovations which will be "easiest" to bring about. It is important at this stage that something innovative is accomplished.

Speed of innovation is specially important in the low IQ stages. An innovator fears that the management may change the policy as a result of general resistance to change.

Maximum return on investment is not so important a criteria at the early stages of IQ development as the innovator ascribes considerable value to the improvement of institutions' image.

It is important to recognise that innovators may not be able to function effectively in a low IQ environment and therefore require support.

As the IQ develops more people become involved in the act of innovation and more people begin to take pride in the organisations' innovative performance.

We must however remember that the limitations to innovation in our environment are many. The cost of change is a major limitation on innovation. Vision and risk taking as another very primary limitation to innovation.

The pattern of the educational system also determines successful innovation in the society. The management at all levels should be conscious of these limitations if innovation has to be successfully promoted.

The key to improvement of overall innovation lies in spreading and understanding of this process through the institutions and throughout government. It is absolutely necessary that those in position of leadership or authority be enlightened about the role and the process of research and innovation. Special efforts should be made to support research and innovation. A cell for study and promotion of innovation would be most appropriate at the present juncture in our country. These studies could establish courses in institutions specially designed to spotlight the problem of innovation and teaching the techniques for dealing with them. This could produce the individual researcher and innovator who is crucial to the process of innovation. A student can emerge with a head start on the road to becoming that rare and much needed entity, the professional innovator.

THE INFLUENCE OF TECHNICIAN EDUCATION ON ECONOMIC DEVELOPMENT BOTH LONG-TERM AND SHORT-TERM IN INDONESIA

by

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1. Introduction

The objective of technical education in Indonesia have not been clearly defined until the beginning of the national development plan.

The situation was, that at that time the technical schools grew rapidly and it was not planned according to the need of the employment but more or less based on the social demand. Therefore, it was not able to discuss matter such as quality, relevancy of the technical education.

Since 1969, efforts have been made to recognize and to plan the technical education system according to the need of the national development plan.

In this effort, matter such as the objectives, quality, relevancy, efficiency and effectiveness have been intensively studied and formulated as an integral part of the national development plan.

2. The National Development Plan

The development plan of Indonesia are divided into: Long range programme which is usually called "Development Era of 25 years", i.e. Five-Year Plan I to Five-Year Plan V. The main aim of this plan is to create the strong basis to grow and further to base on the national develop strength towards justice and welfare society based on "Pancasila". The stress on the long-term development plan is on the sector of economy and at the same time to keep the balance between agriculture and industry.

The long range programme should also be able to bring fundamental changes on the economic structure of Indonesia, so that the national production which derive from any sector outside agriculture should be able to grow larger and larger and accordingly people who live on the sector outside agriculture will increase.

Medium range plan of five years. The objectives of the long-term development plan will be reached through the five years development plan or "Repelita".

The emphasis of the five years development plan are as follows:

Repelita I : Development on agriculture and industry sector which support agriculture sector.

Repelita II : Emphasis on agriculture sector that raise processing industry from raw material to prepare material.

Repelita III : Emphasis on agriculture sector and to raise the industry which process the raw material to manufacture goods.

Repelita IV : Emphasis on agriculture while the industry produces heavy machines and light ones.

Repelita V : Will continue the prior programme and will be developed in next Repelitas.

Short range of yearly programme which is actually in rolling plan in order to achieve the target of each five years plan.

3. The Role and Mission of Technician Education in Indonesia

The role and mission of technician education in Indonesia, is to provide the trained and skilled technician in quality and quantity which is relevant to the need of the national development.

The main problem we have been facing is to fill the gap between the professional engineer and operative level, that is we are lacking more qualified technician than professional engineer.

4. The Development Programme of Technical Education in Indonesia

In the efforts of the government to renew the education in Indonesia, a middle-level technical education system oriented to "development" has been pioneered. Through this new system it is hoped that technical education institutes (known as S. T. M. Pembangunan) will be able to produce manpower directed more to actual needs.

The planning and development of technical education is based on creating a balance between: manpower needs, economic absorption of manpower, educational aspirations of the community and abilities needed for "development" in the broadest sense of the word, and intelligence and skills.

S. T. M. Pembangunan pioneer project uses 4 years system, the ratio of practice and theory are 40% to 60% it means the students will receive 20 hours (periods) practice per week and during 4 years, they will receive 2,400 hours (clock) practice.

The main problems will be solved are relevancy, efficiency and effectiveness.

In order to meet some of the need of technician for short or medium range, there have been also starting to: establish Technical Training Centres, develop several of the existing senior technical schools (the target is 80 schools until 1979), will be operated with new curriculum, preparation of available books which are up to date and so on.

Target of middle programme will be attained in 1979 (the end of 2nd Repelita) are to fulfil the need of technician on middle level, i.e. tradesmen and trade technician, more or less 55 percent from the need. It is estimated the need of technicians are about 41,000 persons in 1979. So the output target of senior technical schools will be about 22,500 persons who have been well trained.

In 1969, the total government senior technical schools (S.T.M.) were 411, and the enrolment were about 70,800 students.

It is estimated graduates (outputs) from these schools were $1/3 \times 70{,}800 = 23{,}600$ persons.

Suppose 10 percent schools were considered good quality, it means graduate from qualified schools were produced only 2,360 persons.

In comparing the output 1969 and 1978, it is expected they become almost ten times.

The results have been achieved in first five-year plan (Repelita I) were: establishing 8 Senior Technical School Pioneer Projects (S. T. M. Pembangunan pioneer projects) to produce industrial technician/trade technician/"Terminal II"$=T_2$, establishing 4 Senior Technical Schools of Agriculture, establishing 5 Technical Training Centres which are supported by World Bank to produce Tradesmen/"Terminal I"$\times T_1$, upgrading more or less 1,500 technical teachers, rehabiliting about 60 Junior and Senior Technical Schools and also making seminars, workshops and other activities in order to develop Technical Educational Planning.

The development of Technical Education Programme during "Repelita II" (1975 to 1980) are: continuing the result of first five-year plan (Repelita I), raising and constructing Senior Technical School Pioneer Projects (S. T. M. Pembangunan pioneer projects), 4 Agriculture Senior Technical Schools will be opened in 1975, the improvement of 15 S.T.M. of Agriculture will be carried out, those 5 T.T.C. will operate in 1975, more technical teachers will be upgraded and sent abroad, translations, writing and reproducing of text-books will be spread, establishing 4 more T.T.C., developing the Regional Technical Educational Planning and to complete 80 Senior Technical Schools with workshop facilities in order to operate the new curriculum, establishing such as "Technical Teachers' Training Institute", etc.

5. Conclusion

We have tried to improve the quality of the technician education and make more relevant to the need of the national development. But, there are still many problems to be solved, and in their connection, any co-operation with other member countries of the Colombo Plan of course would be quite welcome.

Prospects in the coming years

In the IBRD report No. 443—Ind, May 10, 1974 which the topic, "Education Sector Survey Report", is explained or suggested as follows:

Projected Average Annual Education Training Requirements Between 1971 and 1981 by skill level (in 1000's rounded).

	Assumed	*Annual GDP*	*Growth of*
	7%	9%	11%
Level A. (Professionals, university, education)	8	11	14
Level B. (Technicians, post-secondary training)	20	29	37
Level C. (Skilled workers, vocational training)	41	56	72

The figures in "Prospects in the coming years" show the estimation of the needs of manpower each year from 1971 still 1981. The situation at this time in Indonesia is showing that the technicians, post-secondary training (level B) and skilled workers, vocational training are relatively in very small numbers. All these problems strengthen the basic programmes to build and to develop the Technical—Vocational Education in accordance with the need of the development.

If all the Technical—Vocational Education programmes can be fulfilled/performed and succeed, then at the end of Pelita II (Second Five-Year Plan), we can produce about 55 percent of the needs of manpower in secondary level for annual GDP growth 7 percent (the lowest growth of GDP). Considering that the vocational private schools are still weak and the industries are just growing and therefore a great part of the needs of manpower each year must be produced by the Institute of education and training abroad, possibly it can reach till 75 percent.

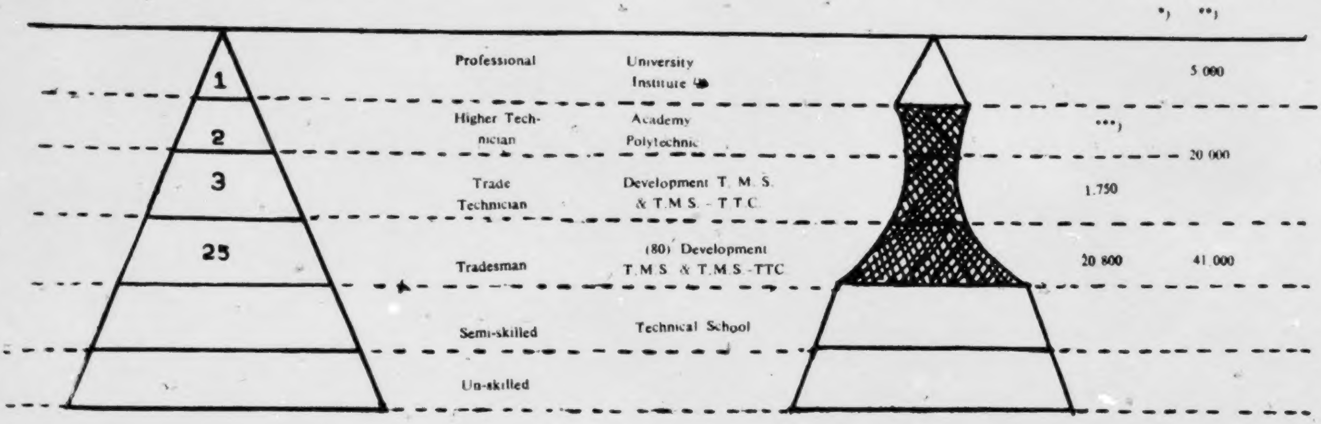
The conclusion is, that the development of the Indonesian Economy till 1981, the needs of all kinds of manpower who are a great part from candidates manpower, must be produced by State Vocational Schools. It is expected that the role of private vocational schools and industrial education can be increased in accordance with the economy development in Indonesia.

Annex II

According to "Pan Indian Asean Conference on Technical Education and Training, at Perth, Australia, August 1966 and in Wellington, 1973", concluded that there are lack of industrial manpower particularly in Higher Technician, Trade Technician and Tradesman.

Pyramid of manpower in developed industrial countries

Pyramid structure of manpower in developing countries


*)
**)
1
Professional
University
Institute
5 000
2
Higher Technician
Academy
Polytechnic
***)
20 000
3
Trade Technician
Development T. M. S.
& T.M.S. - T.T.C.
1.750
25
Tradesman
(80) Development
T.M.S. & T.M.S.-TTC
20 800
41 000
Semi-skilled
Technical School
Un-skilled

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*) Preparation of manpower through state Technical Middle Schools at the end of Pelita II (Second – Five year Plan) with the projection of minimum 55%.

**) Estimation of the needs of manpower each year according to World Bank projection (with the lowest GDP, 7%, from 1971 till 1981

***) Still in planning

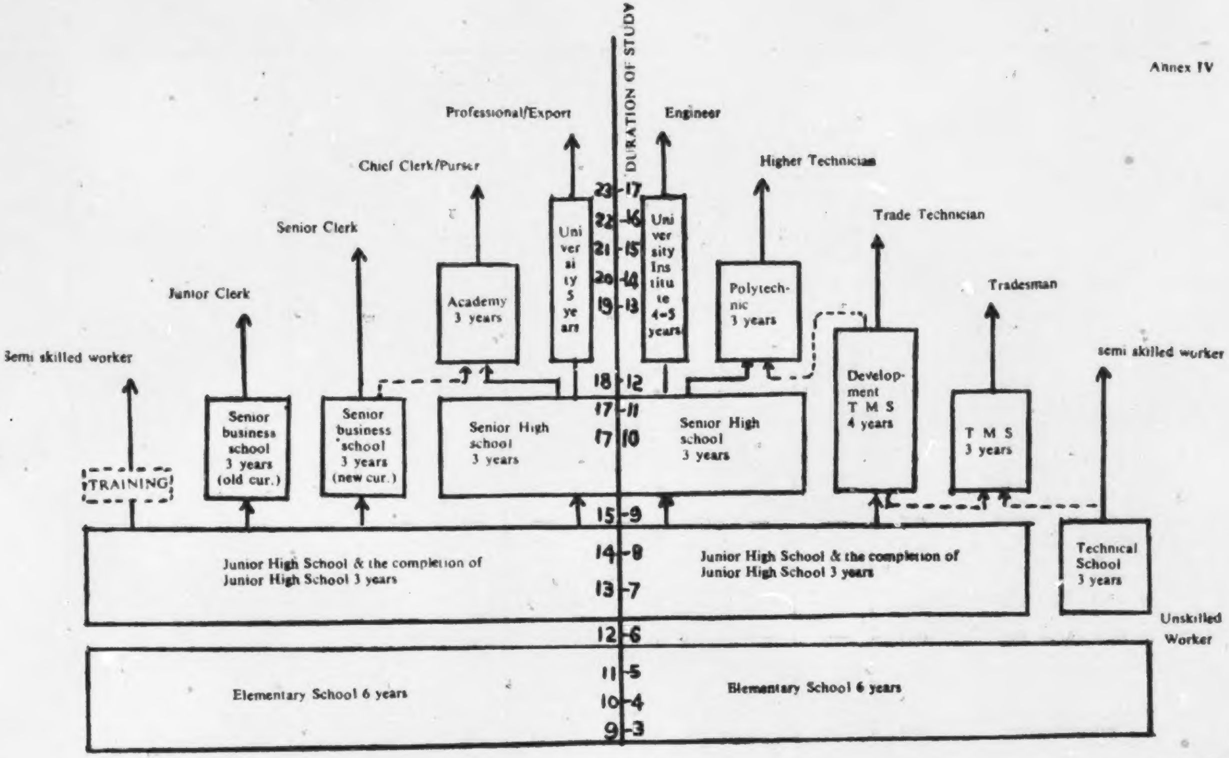
Annex III

Analysis of graduates of Technical Middle School

No. Schools	1975			1976			1977			1978			Explanation
	C	T1	T2	C	T1	T2	C	T1	T2	C	T1	T2	
I. STM. Pembangunan (Pilot Project)													(1) In Academic year 1978 (the end of pelita II) the maximum capacity of Technical Middle Schools are able to produce 22.550 students. (2) A sum of graduates 22.550 persons = 55% from 41.000 persons who are needed in every year (Low projection assumption of World Bank) (3) When STM. should pass 75% from the needs, in means they should pass about 75% from 41.000 30.750 persons/p. year. (4) In order to find additional graduates about 8.200 et needs completely additional STM. about 50.
1.1. Jakarta	—	—	150	—	—	150	—	—	150	—	—	150	
1.2. Semarang	—	—	150	—	—	150	—	—	150	—	—	150	
1.3. Jogyakarta	—	—	250	—	—	250	—	—	250	—	—	250	
1.4. Surabaya	—	—	—	—	—	—	—	—	200	—	—	200	
1.5. Ujung Pandang	—	—	—	—	—	—	—	—	150	—	—	150	
1.6. Bandung	—	—	—	—	—	—	—	—	80	—	—	100	
1.7. Temanggung	—	—	—	—	—	—	—	—	50	—	—	100	
1.8. Pekalongan	—	—	—	—	—	—	—	—	75	—	—	100	
II. Technical Middle													
(2) School of agriculture													
2.1. Jomber	—	—	—	—	—	—	—	150	—	—	150	—	
2.2. Boyolali	—	—	—	—	—	—	—	150	—	—	150	—	
2.3. Tangerang	—	—	—	—	—	—	—	150	—		150	—	
2.4. Metro	—	—	—	—	—	—	—	150	—		150	—	
(3) TTC. Modan, Jakarta Surabaya and Ujung Pandang	—		—	—	4.500	—	—	4.000	500	—	4.000	500	
(4) (80) STM. will be completed	12.000	—	—	6.000	6.000	—	3.000	9.000	—	—	12.000	—	
(5) A plan is supported by World Bank (fourth Educational project.													
5.1. (4) TTC.	—	—	—	—	—	—	—	—	—	—	3.300	—	
4.2. (6) STM.	—	—	—	—	—	—	—	—	—	—	900	—	
	12.000	—	550	6.000	10.500	550	3.000	13.600	1.605	—	20.800	1.750	

C = Old curriculum.
T1 = Tradesman.
T2 = Trade technician.

Annex IV


DURATION OF STUDY
Professional/Export
Engineer
Chief Clerk/Purser
Higher Technician
Senior Clerk
Trade Technician
Junior Clerk
Tradesman
Semi skilled worker
semi skilled worker
Academy 3 years
Uni ver si ty 5 ye ars
Uni ver sity Ins titu te 4-5 years
Polytech- nic 3 years
Develop- ment T M S 4 years
T M S 3 years
TRAINING
Senior business school 3 years (old cur.)
Senior business school 3 years (new cur.)
Senior High school 3 years
Senior High school 3 years
Junior High School & the completion of Junior High School 3 years
Junior High School & the completion of Junior High School 3 years
Technical School 3 years
Unskilled Worker
Elementary School 6 years
Elementary School 6 years
23-17
22-16
21-15
20-14
19-13
18-12
17-11
17 10
15-9
14-8
13-7
12-6
11-5
10-4
9-3

Developing of Technical Education System

COLOMBO PLAN BUREAU
NATIONAL SEMINARS, COUNTRY WORKSHOPS AND REGIONAL COLLOQUIA

The Colombo Plan Bureau has held the following National Seminars, Country Workshops and Regional Colloquia with the active co-operation of the member governments concerned:

National Seminars

"Approaches to Co-operation between Industries and Institutions in Technical Training"

—Colombo, Ceylon .. February 1965
—Bangkok, Thailand .. October 1965
—Manila, Philippines .. March 1966
—Singapore .. November 1967
—Teheran, Iran .. June 1968

"Manpower Assessment and Educational Planning"
—Colombo, Ceylon .. June 1966

"National Planning of Vocational and Technical Training"
—Lahore, Pakistan .. July 1969
—Tjipajung, Indonesia .. December 1969
—Petaling Jaya, Malaysia .. June 1970
—Seoul, Republic of Korea .. August 1970
—Kathmandu, Nepal .. June 1972
—Male, Republic of Maldives .. June 1974
—Dacca, Bangladesh .. February 1975

"Technical Education and Training"
—Madras, India .. December 1972

Country Workshops

"New Directions in Vocational Guidance"
—Marikina, Rizal, Philippines .. February 1974

Regional Colloquia

"Intra-Regional Technician Training"

—New Delhi, India .. April 1965

—Bangkok, Thailand .. June 1967

—Singapore .. May 1969

—Manila, Philippines .. March 1971

—Karachi, Pakistan .. April 1973

—Kuala Lumpur, Malaysia .. April 1975